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THE CAPITAL BUDGETING CONTROVERSY: PRESENT VALUE VS. DISCOUNTED CASH FLOW METHOD—

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Accounting Education—Financial Statement Ratios—Machine Hour Costing

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The Capital Budgeting Controversy: Present Value vs. Discounted Cash Flow Method

by GERALD A. POLLACK

IN RECENT YEARS much attention has been devoted to the development of techniques for allocating expenditures for plant and equipment in such a fashion as to obtain the maximum possible returns from a given capital budget. Numerous systems for evaluation have emerged, most of which provide what are in effect profitability indexes that rank proposed projects in the order of their desirability and enable managements to distinguish the profitable from the unprofitable.

That some projects must be more profitable than others seems obvious. But it does not follow that it is a simple matter to determine which of two projects is more profitable. Those who have attempted to find in the literature on capital budgeting a straightforward exposition of a single, generally-agreed-upon method for the optimal allocation of investment funds will have had occasion to observe with regret that there is no general agreement, and that numerous conflicting systems appear to exist side by side, each with its own advocates and each claiming advantages over the other systems.

This paper represents an attempt to analyze some of the conflicting methods and to choose among them on the basis of the validity of their assumptions and reasonableness of their implications. To begin, it is convenient to examine some fundamental financial characteristics of investments, for a clear understanding of such characteristics itself does much to limit the area of inquiry.

The Importance of Time and Cash Flows

The crucial dimension which distinguishes investment expenditures from other kinds of expenditures is time, as investments are essentially outlays of funds in anticipation of future returns.[1] This presence of time as a factor in investment

[1] Strictly speaking, of course, the revenues associated with any particular business expenditure almost always accrue some time after that expenditure is made. But paying an hourly worker for the production of something which is sold only a month later is not customarily considered investing in labor services. The term "investment" should probably be limited to situations where investment expenditures and the last of their associated receipts are separated in time by at least one year.

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is fundamental rather than incidental for the purpose of evaluating investments. To the investor, time is crucial. A sum received today is worth more than the same sum to be received tomorrow, for if received and invested today it will have grown in value by tomorrow. Thus, in evaluating investment projects, it is important to consider the timing of returns on investment. Time, in effect, is the dimension through which the monetary variables involved in investments —the capital outlays and subsequent receipts—must be related.

It follows that any acceptable system of investment evaluation must provide for consideration of these variables:

1. The amount of initial outlay required.
2. The amount and time distribution over the useful life of an investment project of all its net cash earnings.

It follows from the emphasis on the time value of money that it is actual disbursements and receipts with which the analysis must be concerned. This implies that for present purposes all tax effects must be taken into account: to a company the cost of capital is its after-tax cost, net cash earnings are its after-tax net cash earnings. Noncash charges against income, such as depreciation, which do not affect the amount of before-tax cash flows, are relevant only because they reduce taxes and so affect after-tax cash flows.

Methods of Evaluation

On the basis of the requirements outlined, a number of investment evaluation techniques may be ruled out for serious consideration. These have in common their origin in accounting concepts used in the construction of standard financial statements. They include the following:

$$\text{Return on investment} = \frac{\text{average annual income}}{\text{total original investment}}$$

$$\text{Return on average investment} = \frac{\text{average annual income}}{\text{average total investment}}$$

$$\text{Payback period} = \frac{\text{total original investment}}{\text{average annual income}}$$

These methods all fail to consider both the time distribution of income receipts and the total income generated over a project's lifetime: two projects may have the same average annual income even if the bulk of earnings accrues early in the life of one project and late in that of the other; moreover, two projects may have the same average annual earnings, even if the total earnings

they generate over their respective useful lives differ. In the case of the payback method, it is also clear that two projects may have the same payback period even if one project's earnings cease shortly after the full return of capital, while the other's continue indefinitely. Thus, these methods and variants of them do not meet the minimum conditions previously stated.

The Discounted Cash Flow Method

The *discounted cash flow method,* which has grown prominent among sophisticated investment evaluation techniques, avoids the limitations inherent to the methods discussed above. This method is frequently referred to by other names, including the following: investor's method, profitability index, internal rate of return method, interest rate of return method, annuity method, and return on investment method. (This wealth of different names generally imposes on the reader the task of examining the substance of the method being discussed before it can clearly be identified.) The method itemizes as separate terms in an equation each year's cash receipts from an investment project and applies discount factors which increase as earnings become more remote in time. The object is to compute a rate of return such that a project's cash flow discounted at this rate will equal the initial investment.

The method's mathematical formulation is based on the algebraic treatment which is common to all calculations involving compound interest. Suppose that we invest $200 at five percent compounded annually for two years. At the end of the first year we will have our principal, $200, plus $10 of interest, or $210, which may be stated algebraically as $200\ (1 + r)$, where r represents the interest rate. This now represents the new principal which is invested for another year. At the end of the second year we will have $210 plus five percent interest on it. Thus we will have $220.50, or $200\ (1 + r)^2$. If we were to invest this sum for yet another year we should have at the end of the third year $200\ (1 + r)^3$, and so forth.

Now suppose we knew that for a present investment of $200 we would get $220.50 at the end of two years. We could then compute the rate of return by solving for r in the equation $200\ (1 + r)^2 = 220.50$. The same equation may be written $200 = \frac{220.50}{(1 + r)^2}$ If in this example we now substitute symbols for the numbers, calling the investment C and the return E, we have the essential symbolic formulation of the discounted cash flow method: $C = \frac{E}{(1 + r)^2}$

Of course, earnings may accrue not only during one year, but during many. Accordingly, as many earnings symbols are required as there are years during which earnings are generated. Thus, the general formula used by the discounted cash flow method is:

$$\text{Equation 1} \quad C = \frac{E_1}{1+r} + \frac{E_2}{(1+r)^2} + \frac{E_3}{(1+r)^3} \cdots\cdots \frac{E_n}{(1+r)^n}$$

where E_1, E_2, E_3, etc., are the net cash earnings of years 1, 2, 3, etc., C is the required investment, and r is the rate of return. E_n is assumed to include the after-tax liquidating value, if any, of the project.

When using the discounted cash flow method, an analyst must determine C, the amount of required investment, and estimate the net cash flow over the investment's life. He can then solve for the remaining unknown, the rate of return.

In economic terms, r is the rate of interest at which the investor could borrow the needed investment funds and just repay his loan with interest with the returns, leaving nothing for himself. In other words, it is the maximum rate of interest he could pay without having to subsidize a project. The profitability of a prospective investment is then judged by comparing this rate with the rate at which money can actually be obtained. If, for example, the rate of return on an investment is 20 percent and funds could be obtained at 10 percent, the investment is profitable. The higher the rate of return relative to the market cost of capital, the more profitable is the investment.

The Present Value Method

It is possible to derive another method of investment analysis from the same formula as is used in the discounted cash flow method. While the discounted cash flow method seeks to find the maximum rate of interest at which funds invested in any given project could be repaid with the earnings generated by that project, the other method, called the present value method, asks what amount could be invested in a given project so that its anticipated earnings will exactly suffice to repay this amount with interest at the market rate. Under this method, the profitability of a project is ascertained by comparing the amount which meets the stated condition with the actual amount of investment required by the contemplated project. If a project's earnings could return with interest at the market rate an amount of capital greater than that actually required for investment in the project, the project is judged profitable. If a business could borrow more than is actually required for investment in a project and repay

this greater amount with interest from the project's earnings, it follows that it could borrow exactly the smaller amount needed and, after repaying this with interest, retain some of the earnings for itself.

In terms of the formula shown above, the present value method treats r, the unknown under the discounted cash flow method, as the known cost of capital and solves for the first term of the equation. Under the discounted cash flow method this first term is the required investment. Under the present value method it is the value of all future earnings discounted to the present by the market cost of capital. If we call this amount V, the formula states that:

$$\text{Equation 2} \quad V = \frac{E_1}{(1+i)} + \frac{E_2}{(1+i)^2} + \frac{E_3}{(1+i)^3} \cdots\cdots \frac{E_n}{(1+i)^n}$$

where E_1, E_2, E_3, etc. are the net cash earnings of years 1, 2, 3, etc. and i is the market cost of capital.[2]

Under the present value method the profitability of investment projects is determined by comparing V with C; the greater the ratio $\frac{V}{C}$, the more profitable is the project. This ratio states the present value of a project per dollar of actual investment. As such, it could be thought of as a percentage. For example, a ratio of 1.4 means that the present value of the project is 140 percent of its cost. Only those projects are profitable for which $\frac{V}{C}$ is greater than unity, because, where this condition does not hold, the funds required for investment cannot fully be repaid with interest from earnings.

Differences in Relative Ranking; Superiority of the Present Value Method

Since the discounted cash flow and the present value methods answer different questions, it should perhaps not be surprising that they sometimes rank the same projects differently. Nonetheless, this is troublesome for the analyst who

[2] This formula can be applied also when the market cost of capital is expected to change from year to year. If i_1, i_2, i_3, etc. are the market rates expected in years 1, 2, 3, etc., the formula reads:

$$V = \frac{E_1}{(1+i_1)} + \frac{E_2}{(1+i_1)(1+i_2)} \cdots\cdots \frac{E_n}{(1+i_1)(1+i_2)\ldots(1+i_n)}$$

This refinement, however, is not possible under the discounted cash flow method, where a project's rate of return is compared with the cost of capital, for there is no one market rate with which the comparison can be made. In such cases, the discounted cash flow method cannot be relied upon to discriminate between profitable and unprofitable projects, even if it would otherwise do so.

is obliged to choose between them. This would not be an important problem if businesses were able to invest in all projects which are indicated profitable by the two methods, since projects which appear profitable under one usually appear so also under the other.[3] But business firms generally do not invest in all projects which appear to be profitable. Instead, they usually provide a capital budget which falls short of financing all such projects, and they wish to spend this budget on that combination of projects which will provide the greatest over-all profit. If following one method would lead to the inclusion in an investment program of projects which would be excluded by the other method, the analyst must proceed with caution and make certain that he chooses the method which ranks projects correctly.

That the choice between these two methods may be critical can be demonstrated by a numerical example.[4] Suppose that we must choose between two projects, each requiring an investment of $1. The first returns nothing the first year, and $4 at the end of the second year. The second returns $2 at the end of the first year, and $1 at the end of the second.

These conditions may be summarized in the following numerical way, where the minus sign indicates a cash outlay:

PROJECT I: —1, 0, 4.
PROJECT II: —1, 2, 1.

Under the discounted cash flow method, the rates of return of the two projects are:

PROJECT I = 100 percent.
PROJECT II = 141.4 percent.

However, under the present value method, assuming a cost of capital of 10 percent, the ratios $\frac{V}{C}$ of the two projects are:

PROJECT I = 3.31
PROJECT II = 2.64

Clearly, the two methods yield different results and, if only one of the two projects can be accepted, the choice of method is critical.

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[3] The two methods identify the same projects as marginal and so establish the same dividing line between profitable and unprofitable projects, provided that, after their initial investment, none of the projects being considered require net cash outlays in any year of their respective useful lives. Given this condition, the statements can be proved as follows: Under the present value method, the borderline or marginal project is the one where $V = C$, or $\frac{V}{C} = 1$. Under the discounted cash flow method the marginal project is one which has a rate of return just equal to the market cost of capital, where $r = i$. But when $V = C$, it follows that r must equal i. This is apparent when V is substituted for C in equation 1, and equations 1 and 2 are compared.

[4] The example cited is taken from J. Hirshleifer's important and incisive article, "On the Theory of Optimal Investment Decision," *The Journal of Political Economy*, August 1958, fn. p. 348.

The remaining portion of this paper will explore the relative merits of the two methods and attempt to justify the selection of one over the other. Since both methods consider the amount of initial investment and the amount and time distribution over the useful life of a project of all its earnings, neither can be dismissed on the same grounds as the methods based on standard financial statements which were discussed earlier. Moreover, there is no obvious reason to select one method over the other in terms of the different question to which each is addressed. It is not clear that it is more relevant to find the maximum *rate* at which funds could be borrowed and repaid from a project's earnings without inflicting losses on the borrower than it is to determine the maximum *amount* which could be borrowed and repaid with interest at the market cost of capital without similarly inflicting losses on the borrower, and conversely.

If some of the implications of the two methods are examined, a persuasive case can be made for the present value method. Referring again to the two examples shown above, it can be demonstrated conclusively that the superior of the two projects is the one with the higher present value and lower rate of return.

> ". . . it is simple to show how, adopting I, we can get to the result II at any interest rate lower than 50 percent—10 percent, for example. Borrowing from the final time period for the benefit of the intermediate one, we can convert—1, 0, 4 to —1, 2.73, 1. (I have subtracted 3 from the final period, crediting the intermediate period with $\frac{3}{1.1} = 2.73$.) We can now get to option II by throwing away the 0.73, leaving us with —1, 2, 1. The fact that we can get to option II by throwing away some wealth demonstrates the superiority of I even though [project I's rate of return exceeds that of project II] provided that borrowing and lending can take place at an interest rate less than the . . . discounting rate of 50 percent."[5]

By similar reasoning, it can be shown that, whenever the two methods rank the same projects in different order, the present value method is the one that ranks projects in the order which, with rational behavior on the investor's part, leads to the higher profits.

The Reinvestment Assumption and Its Significance

This demonstrates the superiority of the present value method, but it does not focus attention on the underlying reason which distinguishes the two methods. The cause of the difference can be shown to be an implied assumption in

[5] *Ibid.*

each of the methods regarding the rate at which earnings generated by an investment can be reinvested. That such an assumption exists, however, is by no means self-evident, and a number of analysts have denied, in the case of the discounted cash flow method, that there is any assumption concerning a reinvestment rate. Consider, for example, the following statements:

> "Contrary to statements sometimes made by proponents of other compound interest methods, the discounted cash flow method involves no assumption as to the rate of return that can be earned on recovered capital." [6]
>
> "[Some] have claimed that the system recommended . . . herein [the discounted cash flow method], requires reinvestment of project earnings at the interest rate of return achieved on the project. It is the authors' belief that the analysis shown . . . makes clear that no reinvestment of profits at any interest rate is involved." [7]
>
> "When we are evaluating the profitability of a project we are testing the earning power of the money while it is invested in the project. What is done with the money after it is returned is completely irrelevant." [8]
>
> ". . . the most significant part of a company's return is obviously the direct cash income from the investment, but this is not all. Another very important part is the incremental income gained by reinvesting that initial cash income. The very use by current methods of compound-interest factors in discounting the direct income automatically provides for the reinvestment factor, but such incremental income is determined at the interest rate estimated for the *proposal*." [9]
>
> ". . . the mathematical manipulations involved in the calculation of [the rate of return] implicitly assume that all intermediate receipts, positive or negative, are treated as if they could be compounded at the rate being solved for." [10]
>
> ". . . the rate-of-return criterion implicitly assumes that funds generated by a proposal can be reinvested at the same rate-of-return as the proposal itself offers, whereas the net present value per dollar of outlay criterion [the present value method] assumes that they can be reinvested at a rate equal to the company's cost of capital." [11]

This abundance of contradictory expert opinion is bewildering. Both sides

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[6] *Return on Capital as a Guide to Managerial Decisions*, N.A.A. Research Report No. 35, New York, 1959, p. 62.

[7] "Interest Rate of Return for Capital Expenditures Evaluation," J. B. Weaver and R. J. Reilly, *Chemical Engineering Progress*, October 1956, p. 408.

[8] "Calculating the Return on Proposed Projects, Equipment or Plant Facilities," Raymond I. Reul, Industrial Educational Institute, Boston, Mass. (Mimeographed), p. 6.

[9] "How to Assess Investment Proposals," Robert H. Baldwin, *Harvard Business Review*, May-June 1959, p. 99.

[10] J. Hirshleifer, *op cit.* p. 350.

[11] *The Management of Corporate Capital*, Ezra Solomon, (Ezra Solomon, editor), The Free Press of Glencoe, Illinois, 1959, p. 16.

cannot be right: either there is or there is not a reinvestment assumption in one or both of the methods under discussion. Actually, it can be demonstrated that a reinvestment assumption exists:

Suppose that we compare the following two investment projects:

	Initial	*Net cash earnings*		
Project	*Investment*	*First year*	*Second year*	*All subsequent years*
A	$100	$200	0	0
B	100	0	$400	0

Under the discounted cash flow method, both projects have a rate of return of 100 percent. (If $100 were invested for one year at 100 percent it would grow to $200, and if invested for two years, to $400.) Because both projects have the same rate of return, they are judged equally profitable under the discounted cash flow method. This implies, however, that $200 at the end of year 1 is equal in value to $400 at the end of year 2. For this to be true, it necessarily follows that the investor *must* be able to reinvest his first year earnings at 100 percent. If he cannot do this, he is unable to transform his $200 at the end of the first year into $400 at the end of the second. And if he cannot transform the $200 into $400 in a year's time, the two projects A and B cannot be judged equal.

The requirement that $200 at the end of the first year be equal in value to $400 at the end of the second year has another important implication. To convert the $400 Project B earns at the end of year 2 into $200 at the end of year 1 an investor would have to borrow against the $400 at 100 percent interest. The discounted cash flow method thus implies that earnings are reinvested or borrowings occur at the same rate as that earned by an investment itself. Actually, neither implication is reasonable. There is no reason to believe that a company can find other investment opportunities at precisely the required rate, and its costs of obtaining capital are not defined by the rate of return on any particular project.

How do the reinvestment and borrowing assumptions appear in the present value method? Here the borrowing assumption is treated explicitly. The method is based on the actual cost to a specific company or investor of funds in the capital market. On this score, the present value method is completely realistic. On the other hand, it does imply that earnings are reinvested at the same rate as the market cost of capital. While the counterpart of this unrealistic assumption causes unreliable rankings under the discounted cash flow method, the assumption here does not distort rankings because its effect is offset by the realistic assumption regarding the terms on which a company can actually obtain funds in the market.

An example will make clear how this offsetting influence operates. Suppose that our cost of capital is 10 percent and that two projects, each requiring an initial investment of $100, have earnings as follows:

	Initial	*Net cash earnings*		
Project	*Investment*	*First year*	*Second year*	*All subsequent years*
D	$100	0	$363	0
E	100	$220	0	0

Applying the present value method, the ratio $\frac{V}{C}$ for Project D is 3.0, and for Project E, 2.0. Project D is thus rated the more profitable of the two. But suppose now that at the end of year 1 we have an opportunity to reinvest Project E's earnings at 100 percent. At the end of year 2, we would then have $440, compared with $363 from an equal initial investment in Project D. It would appear, therefore, the present value method notwithstanding, that Project E leads to the higher profits. This is not so. If we had an opportunity to invest at 100 percent at the end of year 1 but received income from Project D only at the end of the second year, we would be motivated to borrow against such earnings to obtain funds to invest at 100 percent if the cost of capital was less than 100 percent. Discounting $363 for one year at the assumed 10 percent market rate, we would have $330 which, if invested at 100 percent for one year, would grow to $660. This $660 bears the same relationship to $440 as the original $\frac{V}{C}$ ratios of the two projects, 3 to 2.

Thus, when investors are able to borrow against future earnings at the market rate to make the most of investment opportunities that may arise, relative rankings of projects under the present value method remain optimal and unchanged regardless of the rate at which reinvestment is possible.

Under the discounted cash flow method, however, borrowings are implicitly assumed to take place at the respective rates of return of the various projects being considered. The relative profitability rankings of various projects remain constant, given any rate of return on reinvestments, only if borrowings against the future earnings of any project occur at an interest rate equal to that project's rate of return. In practice, of course, a company never borrows for more than its actual cost of capital, and it cannot borrow for less. Thus, borrowings on the assumed terms never occur unless all projects' rates of return happen to be equal and coincide with the company's cost of capital.

Having explored the effects of the reinvestment assumptions on relative rankings, let us analyze their effect on the separation of profitable from un-

profitable investments. As was shown earlier, the methods usually establish the same dividing line between profitable and unprofitable projects. At this dividing line, marginal projects have a rate of return equal to the cost of capital. For marginal projects, therefore, the reinvestment assumptions of both methods imply reinvestment at the same rate, the cost of capital rate.

Suppose now that we consider a project which is actually unprofitable according to both evaluation methods. By reinvesting its earnings in a second highly profitable project, the initial investment, related to the entire chain of earnings to which it leads, might appear profitable. Thus, abandonment of the restrictive reinvestment assumptions of the two methods might lead a company to embark on a chain of investments on the basis of its over-all profitability when actually one of its links may be unprofitable by itself and unnecessary for the rest of the chain. Clearly, holding cash, reducing debt, or lending funds at some market rate is preferable to investing in any project which is not essential for the profitability of other investments, if the project has a rate of return less than the cost of capital and a present value less than its cost.

Neither the present value nor the discounted cash flow method implies reasonable reinvestment assumptions, but this at least has the advantage that projects which are rated as unprofitable under either method are not made to appear profitable because favorable investment opportunities exist elsewhere. Conversely, profitable projects are not made to appear undesirable if profitable opportunities for reinvestment do not exist. In short, when the two methods correctly identify profitable projects, the reinvestment assumptions of both methods serve the useful purpose of clearly separating profitable from unprofitable investments, thus assuring that only profitable investments are undertaken. But it must be noted here that the discounted cash flow method, unlike the present value method, sometimes provides ambiguous and erroneous solutions. Therefore, the reinvestment assumption of the discounted cash flow method does not suffice to assure that only profitable projects are undertaken. This is discussed below.

To sum up, both the present value and the discounted cash flow methods imply that earnings must be reinvested at certain rates. In the case of the present value method, this is a rate equal to the cost of capital. In the case of the discounted cash flow method, there is no single reinvestment rate; instead, the reinvestment rate for earnings from any given project is assumed to equal the rate of return of that project itself.

With regard to the relative rankings of projects, the reinvestment assumption is immaterial in the case of the present value method but crucial for the discounted cash flow method. In other words, modification of the reinvestment assumption does not change the relative rankings in the former method but does

change them in the latter. Moreover, it can be shown that, in cases of conflict between the two methods, the present value method always provides the rankings more consistent with profit maximization.

The underlying reason for the superiority of the present value method is that it explicitly recognizes the availability of a market for funds, and it assumes that individuals and businessess will use this market rationally to enhance their earnings. For relative rankings, the discounted cash flow method does not recognize the existence of such a capital market. If it did, it would be equivalent to the present value method.

The discussion above has emphasized the superiority of the present value method over the discounted cash flow method on the ground that the former but not the latter always ranks projects in the order of their profitability. There is another important reason for preferring the present value method. It can be shown that in certain cases where the present value method yields correct results, the discounted cash flow method offers bizarre, ambiguous and incorrect solutions for reasons other than those already mentioned.

Ambiguous and Erroneous Solutions Under the Discounted Cash Flow Method

Suppose that we consider the following example which has received considerable attention in the economic literature.[12] We own an oil field which, without further capital expenditures on our part, will return oil revenues of $10,000 in each of the next two years, at the end of which time it will be dry. If we invest $1600 in a large pump, we can pump out all the oil within the next year, thereby realizing $20,000 then and nothing in the following year. Relative to doing nothing to alter the *status quo*, an investment of $1600 will yield an extra $10,000 in the first year, and we would have $10,000 less than we otherwise would in year 2.

If we solve the equation, $1600 = \frac{10,000}{1+r} - \frac{10,000}{(1+r)^2}$, for r, we find that there are two answers: r = 25 percent and 400 percent. This confronts us with the impossible finding that the investment of $1600 can grow both at 25 percent and 400 percent while invested in the same project. Moreover, as Professor Solomon demonstrated in the article cited, if the necessary investment in the

[12] See "Three Problems in Rationing Capital," J. H. Lorie and L. J. Savage; "The Arithmetic of Capital Budgeting Decisions," Ezra Solomon, and "A Note on the Arithmetic of Capital Budgeting Decisions," Ed Renshaw, all in *The Management of Corporate Capital*, (Ezra Solomon, editor), The Free Press of Glencoe, Illinois, 1959.

new pump became somewhat more expensive, the profitability of the project would be more clearly established. Thus, for example, if the pump cost $2500, the project's rates of return would both be 100 percent. Such results are hardly gratifying.

The question which this example poses is essentially whether we should be willing to spend $1600 now to get $10,000 in year 1 instead of year 2. This question may be analyzed in the following way: If we want an extra $10,000 in year 1 suppose that we borrow it at 10-percent interest. The following year we can repay the principal with the $10,000 realized from our well, but we still owe $1000 interest. How much would we have to invest now to have $1000 in two years? The answer, of course, depends on the rate at which our present funds could be invested. Suppose that, at the very worst, we can invest at 10 percent. This would require us to invest now the sum of $826.45 which at 10 percent will grow to $1000 in two years. If we had opportunities to invest at more than 10 percent, the amount we would have to invest now would be less. Thus, $826.45 is the most we should be willing to pay for a pump. The investment at $1600, therefore, is unattractive.

Suppose now that we apply the present value method to the problem. Discounted at 10 percent, the $10,000 more in year 1 and $10,000 less in year 2 provide a combined present value of $826.45. With $V = 826.45$, the present value method suggests that the investment be undertaken only if $\frac{V}{C}$ is at least unity. Thus, the pump should be bought only for less than $826.45. The present value method yields the same result as the more complex chain of reasoning outlined above. It should also be noted that the present value method clearly shows the unprofitability of the project at a required investment of $1600 while the discounted cash flow method, although yielding ambiguous results, indicates that the investment at $1600 is profitable.

The reason for the strange behavior of the discounted cash flow method in this case is related to the algebra of the formula used for both the discounted cash flow method and the present value method. In solving for r as the unknown in the discounted cash flow method, the analyst is actually solving for x as the unknown in a complicated polynomial equation of the form:

$$O = -C + \frac{E_1}{x} + \frac{E_2}{x^2} + \frac{E_3}{x^3} + \cdots\cdots \frac{E_n}{x^n}$$

where x represents the term $(1 + r)$. There are as many roots to this as there are years during which earnings are generated. Descartes's rule of signs for equations of this type states that the number of real solutions cannot exceed the number

of reversals of sign in the terms of the equation.[13]

When there is only one reversal of sign, as is commonly the case, the discounted cash flow method yields unambiguous results. But when, as in the example cited, negative earnings appear in the future earnings stream, the method is unreliable. Professor Hirshleifer has shown that some conceivable investment opportunities may have no real rates of return.[14]

Although the formula for the present value method is identical in structure to the formula for the discounted cash flow method, its algebraic meaning is entirely different: the divisors are not unknown but are constructed from the known cost of capital. Thus, for the present value method, the equation is not a complicated polynomial but a simple formula no more involved from the algebraic point of view than an equation of the form: $X = \frac{6}{2} + \frac{7}{4}$. The equation is complicated only from the arithmetical standpoint, for a number of divisions and additions are necessary for a solution. The present value method equation is basically:

$$X = \frac{E_1}{K} + \frac{E_2}{K_2} + \frac{E_3}{K_3} \cdots\cdots\cdots \frac{E_n}{K^n}$$

where every term on the right side of the equation is known and K stands for $(1 + i)$. This is a first degree equation and it has only one root no matter how many earnings terms there may be.

In summary, there are instances when the discounted cash flow method yields ambiguous and unacceptable results. Such instances arise when projects have negative as well as positive earnings during their useful lives. The present value method correctly evaluates projects under such conditions.

Greater Simplicity of Present Value Solutions

Finally, even if the present value and the discounted cash flow methods were indistinguishable with regard to their assumptions and implications, it could still be argued that the present value method should be used on the ground that it is easy to compute the present value of a project but difficult to derive its rate of return.

The substance of this argument has already been outlined in the discussion of the algebraic differences between the formulas as applied to the two methods. There are no general formulas for extracting the roots of polynomials above

[13] See J. Hirshleifer, *op cit.*, pp. 348, 349, and particularly fn. 41, p. 349.
[14] *Ibid.*, p. 249 and particularly fn 42, p. 349.

the fourth degree. Consequently, solutions under the discounted cash flow method must generally result from trial and error procedures using compound interest tables. A number of ingenious methods for making this task easier have been advanced.[15] However, no one could fairly say that this task, in comparison with what is required to find the present value solution, is appealing. Under the present value method there is no need for trial and error work, which is a repetitious and time consuming procedure. All that is necessary is division (or multiplication, if reciprocal factors are used), addition of the terms of the equation and, finally, computation of the ratio $\frac{V}{C}$.

Summary and Conclusions

This paper has analyzed a number of problems encountered in capital budgeting. Several methods of evaluation were dismissed on the ground that they do not meet the minimum requisites of an acceptable method. Discussion then turned to the discounted cash flow and present value methods. It was found that the two methods do not always rank the same projects in the same order of profitability and that, in cases of conflict between the two methods, the present value method can be demonstrated to provide the rankings consistent with profit maximization. The differences in relative rankings by the two methods were found to arise from an implied assumption common to both that earnings must be reinvested at certain definite rates. Although any such assumption is unreasonable, it was found to be immaterial in the case of the present value method but crucial in the case of the discounted cash flow method.

It was further found that, in certain conceivable but uncommon situations where negative as well as positive earnings are generated by an investment, the discounted cash flow method provides multiple solutions, none of which may indicate actual profitability. The present value method treats such situations correctly and without complications. Finally, it was argued on behalf of the present value method that it is far simpler to apply to actual problems than is the discounted cash flow method; the mathematical operations necessary to obtain solutions are substantially simpler in the case of the former than the latter.

[15] See particularly "Profitability Index for Investments," Ray I. Reul, *Harvard Business Review*, July-August 1957, pp. 125-129.

For Next Summer—More Industrial Accounting Internship Programs

by PHILIP E. FESS*

GREAT CONCERN exists over the quantity and quality of accountants entering the field of industrial accounting. On one hand, industry points out many weaknesses of present educational programs, including poor secondary school training, lack of current teaching materials, program inadequacy at the college level and similar defects. Yet, on the other hand, industry sorely needs more accountants. The improvement of collegiate education, coupled with the possibility of attracting more and better accounting students to industrial accounting, are the problems.

Undoubtedly collegiate education for business needs adjustment. On this point, I find many colleges subjecting their curriculum to a thorough analysis in an attempt to provide the best in business education. In addition to this critical self-evaluation and adjustment, the universities welcome the suggestions and aid of industry. One way in which industry and collegiate schools can cooperate to advance the cause of education is to expand industry internship programs.

Having participated in internship programs in both public and industrial accounting, I can strongly urge upon others the usefulness of a well-organized internship program. They give the student the opportunity to become acquainted with accounting as practiced in the field. From such an internship program, the student, returns to complete his college education with a better understanding of the scope of accounting. An expansion of the internship program would be a step forward in improving collegiate education for business. During the related training period, the student can learn to meet many of those lacks which industry finds so glaring in the college graduate: personnel problems, union-labor relations, generic term awareness, etc.

But how would such a program attract more of the superior students to industrial accounting? With public accounting generally offering increased starting salaries and providing more and more internship programs each year, the superior accounting graduate cannot help but be swayed, at least a little, towards public accounting. Why should not industry show its opportunities equally forcefully to these superior students?

Public accounting generally offers the internship program between December and April, sometimes on a school vacation basis, a quarter basis or a five or six week basis during the school year, in cooperation with various universities. Generally it is found impractical to maintain the program in the summer because of the lighter workload. Industry, on the other hand, could well appeal to the advanced business student with a summer internship program. A closely supervised program could be designed to provide the student with a working knowledge of the functions of accounting and financial activities, such as data processing, cost analysis, operations research, and like matters. In other words, the three-month summer vacation provides an excellent opportunity for industry to expose the student to its financial and accounting organization. In this way, industry can contribute to the improvement of accounting education and at the same time promote industrial accounting as a career.

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Guideposts in Development of Accounting Education

by WILLIAM A. TERRILL

DEVELOPMENTS in accounting education should be related to the growth of accounting. However, in order to evaluate growth to the present and to predict the future growth of accounting, the basic role of accounting in our economy should first be understood.

The Role of Accounting in Our Economy

Various types of economic units* serve the social function of bringing people together so that their efforts may be combined and directed toward common objectives. The manifold needs for production and service in the total economic body are met by individual economic units which specialize in some type or types of production or service. It is with the cells (or units) of the economic body that accounting is primarily concerned and with which accounting is customarily associated as a quantitative methodology. It serves as the primary method for collecting data about these cells of the economic body.

The present role of accounting may be summarized in the following broad objectives it is designed to serve:

1. To provide reliable and efficient recording and processing of enterprise data, both account data and nonaccount data.
2. To provide clear and dependable reports to outsiders by proper presentation of account data and other supplementary data about the enterprise.
3. To meet recurring and special management needs for planning and control information by the appropriate selection and analysis of account data and other enterprise data.

* "Enterprise" is appropriate if reference is to the business firm. "Economic unit" is a more general term.

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The Past and Prospective Growth of Accounting

In broadest terms, there have been three dominant forces which have brought about the development of accounting since 1900. The first has been the great expansion of industrial activity based largely upon the products of scientific research. This expansion has resulted in widespread ownership of large corporate enterprises and greater demands on accounting for internal financial control and for reporting to those outside parties having a financial interest. The second has been the search for increased productivity in industry through the development of modern production systems, with their great emphasis on cost control and efficiency. The third force has been the increase of Government influence in the affairs of business, especially through taxation and regulation.

In making an estimate as to the directions of development of accounting in the next ten years, one would certainly be compelled to assume that all the above forces will continue to be effective in the next ten years. Because of these forces, the demands for accounting and other quantitative information will increase in volume and complexity. Moreover, the time interval between events affecting the enterprise, both external events and internal events, and the necessity for logical decision based on these events will continue to shrink relentlessly. In addition to these basic forces, the following recent and continuing developments will have an impact on the extent of service rendered by accounting:

1. Integrated mechanical and electronic data processing methods which provide significant gains in timeliness and a greater capacity for analysis and synthesis of enterprise data.
2. Statistical and mathematical approaches which assist accounting in the execution of its role and which often depend upon accounting-based information to achieve their solutions, such as applications for:

   Disciplining the quality of source data.

   Reducing the cost of achieving certain clerical tasks.

   Determining the optimum combination and co-ordination of enterprise efforts.

   Exercising effective control over many phases of operations.
3. The accounting profession in the United States is faced with important problems concerning accounting principles and the public accountants' opinions relating to financial statements. Progress and improvement in many areas are necessary, and the profession must assume responsibility for reaching satisfactory solutions to these problems, which will narrow the areas of difference in accounting practice. The American Institute of Certified Public

Accountants is in the best position in the accounting profession to assume the necessary leadership with respect to these problems. The Accounting Principles Board and the Committee on Auditing Procedure have this specific responsibility within the Institute.

What Will These Developments Require?

These developments will require that the accountant learn to become more precise and to grasp more clearly his internal role and external role in the functioning of the American business enterprise. The accountant must strive for precision in many ways:

1. In the definition of each of the types of information needs which the accounting system and total enterprise data system should serve.
2. In the formulation and definition of basic concepts and standards which can be used by the profession in arriving at objective and sound decisions on specific problems.
3. In the formulation and quantification of accounting and other enterprise data concepts which have relevance to the various information needs to be met.
4. In the definition, in consultation with management, of specific problems, so that the appropriate concepts and quantitative techniques can be utilized.
5. In the description of method (processing steps to be followed) so that high volume and complex analyses can be accomplished by using modern data processing devices.
6. In rebuilding audit programs so that the audit techniques used are more clearly related to one or more significant audit objectives.

Therefore, the type of educational program to be constructed should develop capacity for precision. An accountant must also think like a businessman and be concerned that his services provide dependable and timely communication in the business world. He must learn how he can contribute to the flow of funds for financing business enterprise, to the efficient execution of operations, and to the improvement of tax laws and their administration, and how he can assist in the sound settlement of critical business problems such as arise in labor-management disputes. Therefore education for accounting must be thought of with relation to education for business.

For these reasons, it seems useful to consider one of the general conclusions of the competent recent study, "Higher Education for Business," sponsored by the Ford Foundation and prepared by Professors Gordon and Howell:

> "Tomorrow's businessmen will need the kinds of fundamental knowledge and analytical tools that will most help them to cope with the kinds of change that as yet can be only imperfectly foreseen. This means that today's business students should acquire a sound working knowledge in the natural sciences, mathematics, economics, and other social sciences. . . .
>
> ". . . Such knowledge is needed to assess future changes in science and technology, in economic and political affairs and of the place of business in society."[1]

It is also contended in this study that business management will need this knowledge in order to be able to communicate with and make effective use of specialists inside and outside the enterprise. It might be added that specialists of various kinds will also need the same type of background to communicate effectively with business management and other parties having a substantial financial or social interest in business. Other recommendations stress fundamental knowledge, basic analytical skills and avoidance of over-specialization.

Many, but not all, business educators agree that emphasis should not be on training a man for specialized competence in a first position but, rather, on educating a man in such a way as to increase his potential for rising to higher management and professional levels. The emphasis should be on providing a base of knowledge and skills from which he can grow and which will help him grow. It should be on breadth of education. Specialization should not be discarded but it should be limited. It should be limited to that level of initial technical knowledge and competence in a special field which is a minimum requirement for entry into that field. Further, instruction in that special field should be directed toward long-run growth and not toward the requirements of a first job.

About a year ago the American Accounting Association through its Committee on the Scope of the Accounting Major gave a critical evaluation of the strengths and weaknesses of collegiate accounting education. It stated:

> "It is our belief that high standards of academic achievement are maintained by accounting departments, and we are cognizant of the general acceptability to employers of graduates with an accounting major or equivalent. On the other hand, the Committee views with much concern weaknesses of accounting education. These include overspecialization in accounting at the expense of training in business and cultural areas, overemphasis on accounting techniques to the neglect of logical and consistent development of accounting concepts and prin-

[1] *Higher Education for Business*, Robert Aaron Gordon and James Edwin Howell, Columbia University Press, New York, 1959, p. 97.

ciples, inadequate consideration of the uses of accounting data, and uninspiring instruction."[2]

These several critical comments on business and accounting education can be most accurately summarized by saying that the focus should be more on a way of thinking and less on how, the descriptive and procedural aspects.

Requirements for Critical and Orderly Thinking

What is this way of thinking that should be emphasized and how does it apply to the accountant? With complex business enterprises operating in a complex and ever-changing economy, it cannot be assumed that:

1. The preparers of information for external use clearly understand the uses of this information.
2. The preparers of information for internal management use clearly understand the various needs to be met by their recurring and special reports.

Accountants cannot assume that their past conceptions of goals and means are adequate for the present and future needs for information. They must constantly re-examine the objectives to be served and assist in the selection and expression of specific objectives. The selection of objectives requires critical thinking. This may be characterized as thinking which has been systematically criticized by the thinker and others. Critical thinking supplies a needed flexibility to cope with change as it occurs and to avoid being imprisoned by past insights. Critical thinking is also necessary in selecting the data concepts to be utilized for satisfying specific information needs and in choosing from the available methods of developing the data.

But critical thinking is not enough. Orderly thinking is also necessary to assist in precise expression of the objectives and goals set. In both instances cited, critical thinking must be accompanied by orderly thinking to secure a precise statement of the data concepts selected and to schedule the steps, or program the instructions, to secure the type of data needed.

The accountant must be able to work with those responsible for setting goals in related areas and must act as a goal setter in his own areas of responsibility and competence. In order to develop information appropriate to stated goals, he must do the work himself or be able to work with systems specialists and programmers. There must be precision both in the statement of goals and in the statement of procedure to develop information.

[2] "Report of the Committee on the Scope of the Four Year Accounting Major," American Accounting Association Committeee on the Scope of the Four Year Accounting Major, *The Accounting Review*, April 1960.

In sum, in order to work in a complex, changing business environment, the accountant must be able to think critically about goals and means and to think in an orderly fashion to develop the means (or the program) to satisfy the goals. Thus, it becomes apparent that the chief requirements for an accountant to serve in the present and future business environment are critical and orderly thinking:

> *Critical thinking* is required in selecting goals and in selecting means (or devices) to attain goals.
>
> *Orderly thinking* is required in stating goals, i.e., precision, to communicate with those who are to satisfy these goals. Orderly thinking is also needed in expressing instructions to communicate with the men or machines which are to develop the data to satisfy the stated goals.

Implications for Accounting Education

The recommended framework for attaining a broad education and for specialization that will contribute to long-run growth of the individual is made up of three types of college work:

1. In order to understand the role of business in society and its relationship to individuals, other businesses and Government, the student needs a broad liberal arts program including philosophy, economics and political science.
2. In order to understand the accountant's role in business, the student needs to understand the operations and information needs of functional areas of business.
3. In order to execute his role as a public accountant or private accountant, the student must establish the basis for growth to a high level of competence in accounting and achieve a beginning level of competence in statistics, some types of modern mathematics and modern data processing methods.

In one group of schools which has seriously expanded its accounting and business courses, this will mean a complete re-orientation of curriculum and a cutback in hours in accounting and business. In a second group it will primarily mean a shift in emphasis in existing courses. In this second group, there may be occasional deletion of courses that do not serve the ends stated and the occasional addition of a course designed to implement the program.

In reacting to recent reports (the Ford and Carnegie reports) recommending changes in higher education for business, the American Accounting Association Committee on Study of the Reports made this observation:

> "These are delicate matters involving the psychology of learning. They cannot be solved and controlled solely by curriculum re-organization but must be patiently fought out and learned course by course by those responsible for the actual teaching."[3]

This comment applies especially to those schools in the second group. In the past ten years some instructors have been striving to achieve better balance between the procedural and thoughtful in their business and accounting courses. Now, because of the growing demands on accounting and the development of new techniques for analyzing and processing data, the accountant is confronted with new opportunities for service. This makes it imperative that proper balance be attained and maintained between the procedural and the thoughtful in every business and accounting course.

Some extreme advocates of change recommend a complete de-emphasis of procedures and techniques. They have been overwhelmed by the current popularity and emphasis on decision-making. Most sound accounting educators reject the idea that uses and decision-making can be taught without an understanding of techniques. The discussion of ends without the appropriate consideration of means is as open to criticism as the discussion of means without relating them to ends.

Good pedagogy in accounting is largely a matter of proportioning and timing the basic elements in presentation of a particular topic so that significant objectives are critically determined and carefully stated, procedures are formulated, and the procedures are appropriately related to one or more of the objectives.

In the modern business environment, businessmen and accountants must learn to be more precise about objectives and means. To provide the basis for this, educators must do likewise. It means continuing, or undertaking the re-examination of the curriculum. This can only be worked out by educators patiently applying critical thinking and orderly thinking to the selection and precise statement of objectives and means for each course. If there is a clear rationale behind the curriculum and each course, and this is precisely stated and revealed to the student, he is more likely to take his education seriously and to acquire the capacity to learn, think and express himself, which is the desired goal of his education.

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[3] "Report of the Committee on the Study of the Ford and Carnegie Reports," American Accounting Association Committee on the Study of the Ford and Carnegie Reports, *The Accounting Review*, April 1961.

Wanted: Articles Which Confront Accounting Tasks

by ARTHUR F. O'CONNOR*

IT WOULD APPEAR to the casual observer of the numerous articles written on the subject of data processing and, more specifically, EDP, that the "open sesame" to the solution of the many ills and problems with which industry is constantly bombarded is thought by the authors to lie in the simple expedient of expending sufficient funds to defray the cost of installing such equipment. There is no doubt in the writers' minds that we have embarked upon an era of tremendous advancement of business in general and, in particular, those companies that can afford the equipment.

There still remains, however, a very large segment of the industrial community that cannot afford this, and whether or not such additional information and analysis may prove beneficial does not enter the picture. There is another direction in which to look, of course. There are also many articles on the ways and means by which we may reduce the cost of paperwork. We are told perhaps that, after a two-year study by business consultants, paperwork and office routines have been cut down to the point at which a substantial reduction of office workers has been accomplished. Again we find ourselves in difficulties as we reflect upon this. The thought cannot help but intrude that the cost of obtaining such information would have kept the existing office force intact for several years.

The foregoing comments on subject matters of articles appearing in the *Bulletin* engenders the thought that the majority of articles are written either by or for the particular benefit of those who have the most modern and up-to-date accounting equipment at their disposal. It is this thought that prompts the suggestion at this time that there are a great many business firms and accountants who still need advice and guidance on the accumulation of information necessary to the proper conduct of business but at a cost within their reach. Many small-to-medium-size firms depend upon the public accountant for advice and assistance in determining not only the ways and means but also the extent of the accounting information to be furnished to management. This is all to the good, so far as this writer is concerned, but it does not place the responsibility for this vital function where it properly belongs—in the laps of management and the internal accounting staff.

It can be safely assumed that there are many members of N.A.A. still without any likelihood of the assistance of EDP equipment or broad systems surveys. A simple tabulating installation, together with one or two adding machines and calculators, must put together information equally accurate and useful. In these companies the expense factor must be continually borne in mind and the suggestion that more elaborate equipment be utilized in the process would be considered no less than heresy, even though a great deal more information would become available.

A welcome change would be to go back to some of the basic and down-to-earth accounting methods that were instrumental in the development of the expanded accounting equipment. It is quite likely, too, that the appearance of a few articles of this nature would provide the incentive for many more average accountants to submit articles that may prove interesting and of benefit to more people.

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Comparing the Company with Its Industry by Ratios

by WILLIAM E. WESTERDAHL

ONE AREA often overlooked by accountants in providing management with information to guide its decisions toward the desired goals of perpetuating the business and making a profit is the financial structure of the business. Much has been written about reducing costs, accounting practices and procedures, break-even points, reporting to management, organization, etc., but comparatively little appears regarding the basic financial structure of a business. However, if managers were asked to state their foremost problem, financing the business—or lack of financing for it—would be close to the top among the answers, especially in the smaller companies. Often it is only an apparent lack that simply means unwise use of available funds. On the other hand, management often is not aware that financial structure is a problem. Managing a company involves directing and coordinating the research, production, distribution, and financial functions into a smooth working combination. Much effort is directed toward selling, producing and developing new products, but perhaps too little time is taken with the fourth function—financial planning and control.

Every year studies are made of the causes of business failures. These studies are based on the opinions of creditors and information on credit reports. The conclusion usually is that about 90 percent of the failures are management failures—inexperience or incompetence. This would indicate that management often needs guidance in making decisions. In the March 1960 issue of *Dun's Review and Modern Industry,* it was reported that of 2,612 manufacturing firms that failed, inadequate sales and competitive weaknesses were indicated as principal symptoms. In these areas accountants' reports and opinions probably could not have helped much. However, 11.8 percent had receivable difficulties, 10.9 percent had excessive fixed assets and 4.8 percent had inventory trouble. Only 7.8 percent were reported as failing because of heavy operating expenses.

Note: The writer is indebted to Mr. Howard E. Kroll, Regional Specialized Report Manager, Dun & Bradstreet, Chicago, for assistance received in the preparation of this article.

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In other words, business failures attributable to poor financial structures were about five times greater than those due to excessive expenses. If these were the predominant reasons for the business failures, perhaps the accountants should have spent more time on determining financial structure weaknesses and emphasizing to management that it is important to build a sound structure. And, if this is the condition among the companies that have failed, we can assume that many firms, while still solvent, are struggling with the same problems and could be in serious trouble if their sales volume were to drop appreciably.

Ratios as Objective Guides

Executives with accounting or financial background generally are aware of the financial weaknesses in a company but often it is difficult to communicate these ideas to other members of management. When the accountant expresses his opinions, such as "there isn't enough working capital" or "inventory is too high" or "we have too much invested in fixed assets," etc., the executive may feel that it is the accountant's opinion against his own. He may discount the importance of the accountant's findings, ignoring the probability of their factual basis, and thus the situation remains uncorrected. Unless these ideas or situations are communicated to top management in such a way that it can readily understand the situation and see that improvement is necessary, the company will continue to operate under handicaps.

A very effective way to emphazise to management that certain parts of the financial structure are out of balance is to compare the company's figures with those of other similar companies. For example, suppose that the inventory in a particular company is high. The accountant may go to the general manager, production and sales managers, and point this out to them. They, on the other hand, may be perfectly satisfied that the inventory is "all right"; they are always able to deliver to the customers, never have any short-run production headaches, and perhaps have recently built an addition to warehouse the inventory, so there is no space problem. It is the accountant's opinion against that of the other executives, and the accountant may be outvoted.

On the other hand, suppose the accountant were to bring out the fact that the company, in comparison with an average of, say, fifty other companies in the industry, had twice the inventory that the others did, the matter is no longer only the opinion of the accountant. The fact cited becomes an indicator that perhaps the company is carrying too much inventory.

Or it may be fixed assets. Often management is proud of having a large

plant with an abundance of equipment so it can "make anything," and its buildings may be a monument to the president. The financial executive can rather quickly become unpopular with the plant superintendent and general manager if he shows any resistance to expansion of plant and equipment. However, if he is able to show management that, in comparison with some 30 or 40 other firms in the same line of business, the average investment ratio of fixed assets to net worth is, say, only 40 percent and that in the company 90 percent of the net worth is tied up in fixed assets, perhaps management will take a more objective look at the problem, rather than just feeling that the accountant is "too conservative."

Comparisons are not easy. One of the difficulties in comparing one company to another is the fact of dissimilarity in size. If we were to compare the dollar figures of two or more companies, this would not be very meaningful. However, effective comparisons can be made through the use of ratios. Even here, there are pitfalls but there are sufficient reliable advantages to render the endeavor fruitful. The main hazard is comparison of average against individual conditions. A ratio is a computation expressing the relationship of two sets of figures. It may be expressed as either a percentage, such as the profit divided by sales to yield profit as a percent of sales, or as a multiple, such as current assets divided by current liabilities to give the common current ratio.

Ratios may be classified as static ratios, referring to balance sheet items; operating ratios, showing the relationship of expenses to sales; and velocity ratios relating income and expense items to certain balance sheet items.

Sources of Comparative Ratios

The question arises as to what ratios are significant. Every year Dun & Bradstreet publishes "Fourteen Important Ratios" for a number of different lines of businesses. These are:

1. Current assets to current debt.
2. Net profits on net sales.
3. Net profits on tangible net worth.
4. Net profits on working capital.
5. Net sales to tangible net worth.
6. Net sales to working capital.
7. Collection period.
8. Net sales to inventory.
9. Fixed assets to tangible net worth.
10. Current debt to tangible net worth.
11. Total debt to tangible net worth.
12. Inventory to working capital.
13. Current debt to inventory.
14. Funded debt to working capital.

These ratios are published for 12 retail lines, 24 wholesale lines and 36 manufacturing lines. Figures for each of the ratios are provided for upper, median and lower quartiles of responding companies. This information is usually published during the last quarter of the year, covering the previous calendar year.

Robert Morris Associates, a national association of bank loan officers and credit men, also publishes information on a number of different lines of business. This includes composite balance sheets the items of which are expressed as a percent of total assets, as well as composite condensed income statements, with costs expressed as a percent of sales. There is a supplementary study which expands the income statement classifications to:

Net sales	Other general administrative expense
Cost of sales	All other expenses net
Gross profit	Profits before taxes
Selling and delivery expense	Income taxes
Officers salaries	Net profit or loss

These are likewise reported as a percent of sales. In addition to the composite balance sheets and income statements, Robert Morris Associates also publishes the following ratios for the lines of business treated:

Current ratio	Sales/Inventory
Net worth/Fixed assets	Sales/Fixed assets
Net worth/Debt	Sales/Net worth
Sales/Receivables	% profits/Net worth
Cost of sales/Inventory	Sales/Total assets
Day's sales in inventory	% profits/Total assets

Other ratios may be calculated from balance sheet figures. The Robert Morris Associates' figures are not by quartiles. However, the information is broken down by total asset size: firms under $250,000, $250,000 to $1 million, $1 million to $10 million and, in a few cases, $10 million to $25 million, enabling companies to make comparison with firms in their own industries and corresponding asset-size groups.

The Robert Morris Associates' figures include about 90 lines of manufacturing, 44 lines of wholesalers, 36 lines of retailers, plus laundries and dry cleaners, bottlers (soft drinks), and seed companies. The information generally becomes available by late summer for the previous calendar year and may be obtained from the member banks or from the home office of Robert Morris Associates.

Another source of financial statement ratios is found in trade associations which collect these data and make them available to their members.

Ratio Analysis in Correcting Unsound Conditions

It is apparent that many different ratios are available for use. There may be some question as to which are of particular significance. Let us examine some which can be used to ferret out conditions which should be corrected. It may be well to break them into categories that may be considered serviceable to disclose what part of the business is out of line. These categories might be:

Inventory	Fixed assets	Profit
Accounts receivable	Financing	Sales activity

Inventory ratios. Perhaps one of the prime causes of business failures and voluntary liquidations has been either excessive or unbalanced inventory. Except for speculation, management seldom plans to build an excessive inventory. Ratios will not reveal unbalanced inventory but they can be used as a guide to determine if the inventory totals are in line with those of other firms in the industry, or with goals set by management in forecasting financing requirements. These ratios include the following:

1. Inventory to working capital. This shows how the least liquid portion of current assets stands to the total.
2. Sales to inventory. This could indicate too much or too little inventory for the sales volume.
3. Cost of sales to inventory. This shows the inventory turnover.
4. Day's sales in inventory. This also indicates inventory turnover but may be more impressive when presented to management.

There are several dangers from excessive inventory. As discussed later, it uses too much of the working capital so that the company is no longer in a position to meet its current obligations with cash and accounts receivable. Another danger is obsolescence. When inventory fails to turn within a reasonable length of time, there is chance of deterioration or of some new product superseding the product being manufactured. Another danger is that the price of the raw materials may fall. Then the inventory would have to be written down, involving larger losses than if the inventory were at a nominal level.

There is still a fourth problem. It has been estimated that the cost of carrying excess inventory, including interest on investment, runs between 15 and 22 percent per year. This includes storage costs, insurance, taxes, etc. When the inventory is excessive, crowded conditions may necessitate plant expansion to house the inventory, with an accompanying increase in fixed costs. Thus, costs increase without adding value to the product.

There are, of course, dangers from having inadequate inventories. These

include the incurring of excessive out-of-stock conditions, placing many small orders which add to paper work and receiving costs, and which increase production costs because of additional setups, short runs, etc.

An accounts receivable ratio. Funds tied up in accounts receivable are not available for other purposes. Average collection period is a good guide to compare the company's collections with the industry for evaluating the effectiveness of the credit and collection functions.

Fixed asset ratios. Only a certain amount of net worth should be tied up in fixed assets. Ratio guides to point out the degree of soundness of a company's financial structure in this respect are:

1. Fixed assets to net worth.
2. Sales to fixed assets. This ratio may disclose that a business has too large or too small a plant for the sales volume. In making comparison of sales to fixed assets, another problem confronts us. Fixed assets are normally carried at the original value less depreciation. If the assets were purchased in years when the value of the dollar was higher than now, and they have been heavily depreciated, this would result in a very high ratio. On the other hand, a low ratio could reflect an excessive valuation of fixed assets. Thus, if the company's ratios are out of line with the industry ratios, much judgment must be used before drawing specific conclusions in this area.

Financial ratios. Financing the business can be divided into two major categories: (1) procurement of funds from the owners, long-term financing, and short-term sources ("sourcing" of funds) and (2) proper balance and allocation of available funds among cash, accounts receivable, inventory, and fixed assets (rationing of funds). Allocations relate to such ratios as have already been discussed. Ratios which might be useful in evaluating balance in the source of funds would include:

1. Current assets to current liabilities.
2. Current debt to net worth. This could indicate that suppliers may be furnishing too much capital.
3. Total debt to net worth. This supplements the current debt to net worth ratio and should disclose undercapitalization.
4. Funded debt to working capital. This is a test to see if a business could liquidate long-term debts from working capital. If this ratio is over 100 percent, it could indicate that too great a portion of the company's funds is invested in fixed assets.

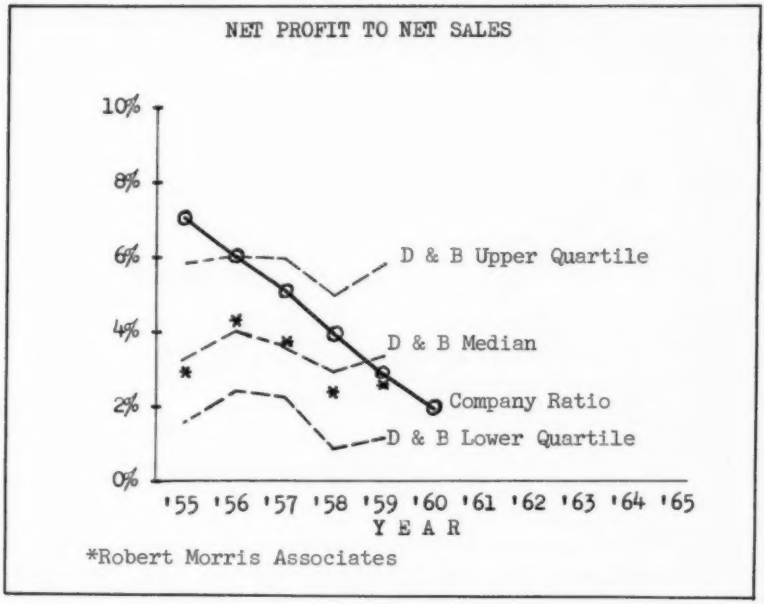

EXHIBIT 1

Profit. Ratios to test profit showings are probably used by most companies today. Management generally watches the profits-to-sales ratio very closely, sometimes overlooking other ratios which are more significant in controlling business operations. Ratios useful for comparing the profitability of a company with others in the industry are:

1. Profit to sales (Exhibit 1). This is a check to determine if margins are in line with those of other companies. Where information is available, it should be supplemented by a comparison of gross profit to sales.
2. Profit to net worth (Exhibit 2). This is a test of the ability of management to earn a return on the owner's investment. It is recommended that the going interest rate on so-called "safe" investments, such as government bonds or bank savings, be considered as the "break-even" point. Profit above this figure is necessary to attract capital where there is more of an element of risk than on "safe" investments.

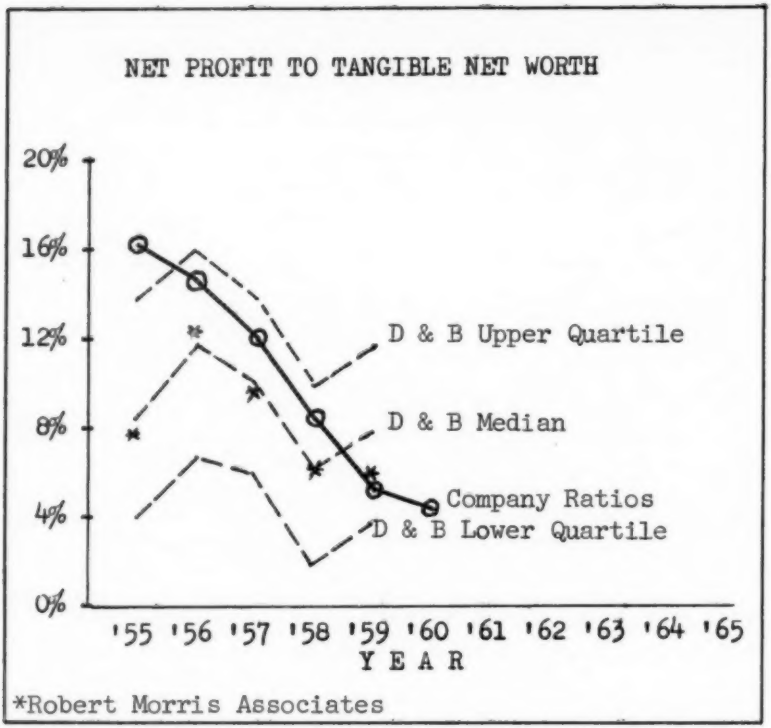

EXHIBIT 2

3. Profit to total assets. This is a test of the ability of management to earn a return on all assets used in the business.

In using profit ratios in comparative analyses, it is essential to know whether the profit figures are before or after income taxes. A further problem in comparability of profit ratios may arise in a closely held corporation, with the question of owner-managers' salaries. Owners may be drawing more (or less) than the going salaries for managers. For making a comparison of the company profit with that of the other businesses, it is suggested that the owner determine what he would pay a professional manager to perform his job. This figure would be substituted for the actual owner's salary, and the pre-tax and after-tax profit figure used for making comparisons. But it must be remembered that deduction of a true salary figure assumes that this is also done in the data with which comparison is made.

Sales activity. Ratios can be used to determine whether or not a company is "over-trading" or "under-trading." These ratios would include:

1. Sales to working capital.
2. Sales to net worth. This is a check to see if the owners have invested too little (or too much) for the sales volume, and if the capital is being used efficiently.
3. Sales to total assets. This supplements the sales-to-net-worth ratio and may show that a business is using too much capital belonging to creditors.

Three Keys to Solvency

Three ratios among all those available can be considered as "keys to solvency." They test the ability of a company to weather a storm in case of a recession or

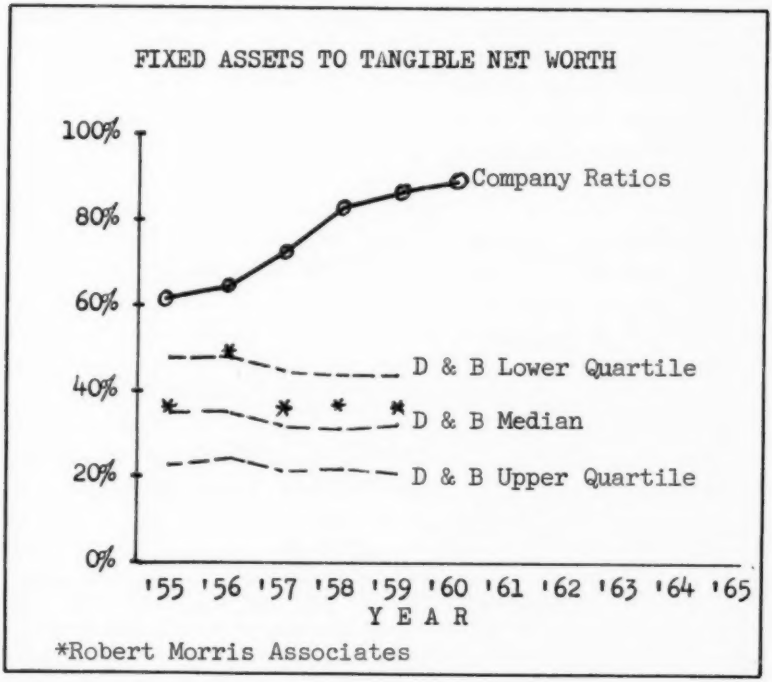

EXHIBIT 3

other form of setback. These ratios—fixed assets to net worth, working capital to sales and inventories to working capital—are probably the most important ones management should watch in guiding a company through periods of stress.

The relationship of fixed assets to net worth (Exhibit 3). Fixed assets are described as the land, buildings, equipment and furniture at book value, less accumulated depreciation. Net worth is described as the owner's capital invested in the business after deducting all intangibles such as goodwill, patents, trademarks and the like. A company's investment in fixed assets should be in proper relationship to its tangible net worth. There is no one answer as to what this relationship should be; it depends upon the line of business. A point to consider is that the more the fixed assets are built up, the higher are the accompanying fixed costs such as depreciation, insurance, taxes, maintenance, heat, light and power. This in turn raises the break-even point and the company may have trouble in making a profit if sales drop off.

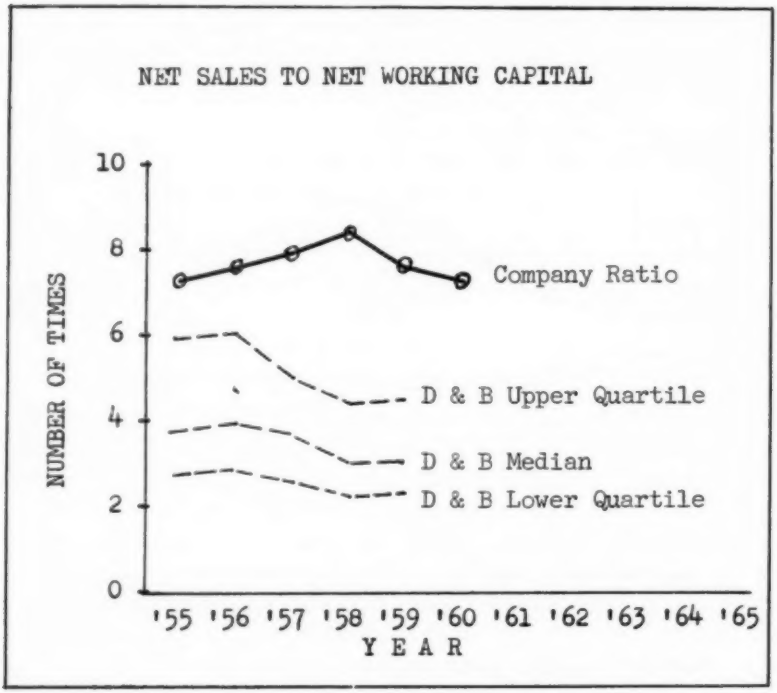

EXHIBIT 4

"Plant-minded" management often feels that it is successful if it has an attractive building and the very latest equipment. If there is an increasing demand for its product, it may feel that it must expand in order to capitalize on this increasing demand and presumably make more profit. It may overlook the fact that, when more and more of its net worth is invested in plant and equipment, there are less funds available for working capital needs such as accounts receivable, inventory, cash, etc. Thus, it may be in a position that, while it has the capacity to meet the greater product demand, it does not have the working capital available to support this increased volume. This is the unhappy situation in which a higher break-even point results, and yet the company must of necessity curtail its sales volume because of the lack of funds for carrying inventory and accounts receivable.

The relationship of working capital to sales (Exhibit 4). Another fundamental is that the working capital of an enterprise should be in proper proportion to its sales. The working capital is described as the difference between the sum of the current assets and the sum of the current liabilities. A small retail store operating on a cash basis and with a good inventory turnover may be able to get along quite comfortably on $5,000 of working capital. However, if the owner were suddenly to expand it to a large department store, where he had to carry accounts receivable and a much larger, and probably slower turning, inventory, obviously the $5,000 of working capital would be grossly inadequate and he would be in serious trouble.

There is no universal answer as to what the working-capital-to-sales relationship should be. A comparison should be made with the industry ratios to guard against "over-trading," previously mentioned. Businessmen feel that the more they sell, the more profit they make. This can be true; however, additional sales volume usually means more capital is tied up in accounts receivable and in inventory. If the additional capital is not provided for by the company, it must borrow, generally by obtaining short-term loans or by delaying payments to creditors. In this situation the company could be in serious trouble if sales volume were to drop and it could not meet its current obligations. As one banker put it, "You can go broke just as quickly by selling too much as by selling too little."

The relationship of inventories to working capital (Exhibit 5). The third key to solvency is the relationship of inventories to working capital. Here again, we have different relationships in different industries but, in general, a company's investment in inventories should be kept within the amount of its net working capital. When inventories exceed net working capital, the current lia-

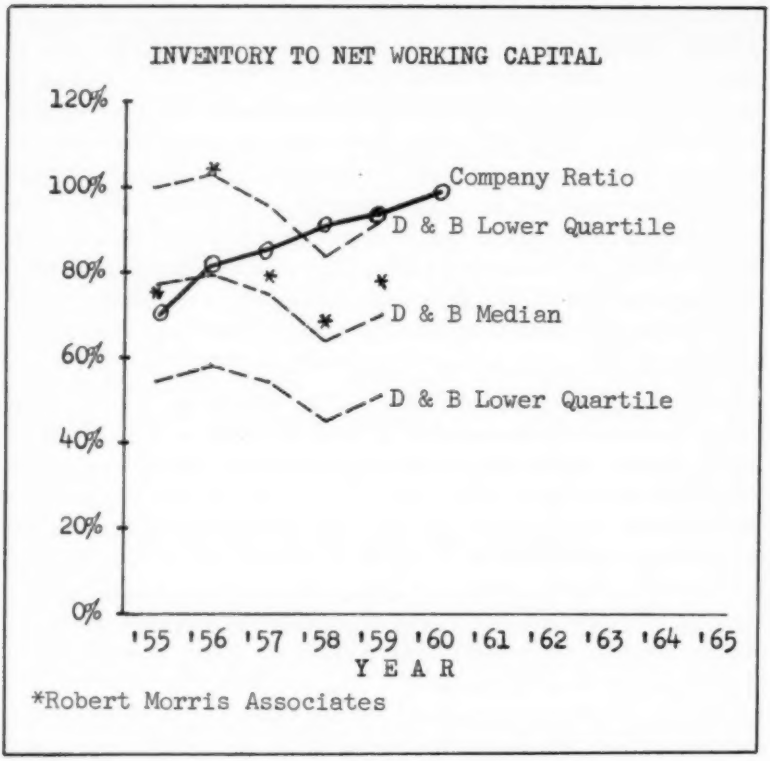

EXHIBIT 5

bilities (debts that must be paid within one year) exceed the cash, marketable securities and accounts receivable which represent claims on funds due within one year. Thus, the company would be forced to liquidate some of its inventory in order to meet its current obligations should it run into a period of stress. This could occur just when customers were slowing down on their buying and it might mean selling the inventory at a considerable discount.

Trends Are Important

Very often a single comparison of a company ratio against published information may not bring a significant trend to light. Also, because it takes considerable time to prepare, compile and publish statements, industry figures are

not available for quite a few months. For these reasons, ratios for a number of years plotted on graph paper, one sheet for each ratio, are highly practical. Generally, the industry ratios will not vary too much from year to year unless the general economic conditions change considerably. Thus, when the company statement is prepared and the ratios are calculated and put on the graph paper, a good comparison can be made immediately with other companies in the industry, on a basis which relies on the picture of a series of years.

One big advantage in plotting these ratios is that it makes it possible to point out to management the direction of the trend. A comparison of company ratios versus industry ratios in a given year might indicate a healthy situation—yet the trend may be in the wrong direction. That is why the exhibits which have been given for particular ratios cover a number of years and illustrate how trends may be followed. In all of them it has been found useful to plot the Dun & Bradstreet figures for the upper, median and lower quartiles. Available Robert Morris Associate's ratios are indicated on the graphs with an asterisk. Superimposed on this is a heavy line which indicates the company's ratio. Thus, at a glance, management not only can compare its ratios with the published ones but also can see significant trends.

The question always arises: when is a ratio out of line? It is suggested that a particular ratio be analyzed closely to determine reasons for variance whenever it is outside the upper quartile or lower quartile range. Company ratios are in line with the "middle half" of the companies included in the sample when they are between the upper and lower quartiles. In other words, one-fourth of the firms are "better" than the upper quartile and one-fourth of the firms are "worse" than the lower quartile of the middle two.

Comparisons with Own Industry Most Significant

It has been assumed throughout the discussion that a portion of the hazards of ratio comparisons would be overcome by making company comparison with other firms in the same industry. While some of the ratio figures may be approximately the same in many manufacturing lines, the industry characteristics might make a comparison with a composite of all industry quite invalid. For example, for the five-year period ending in 1958, the median of the fixed assets to tangible net worth among the shirt manufacturers was about 7 percent, while the median among the petroleum manufacturers was about 87 percent. Some of the ratios do have wide variance based on the nature of the industry, so it is well to compare with the industry rather than with any composite average.

One Type of Help

A well balanced financial structure is important to the well-being of a company. Management seldom has unlimited capital; it is desirable to extract the most value from available funds. Whenever too much is invested in one segment of a business, another segment generally suffers. Too much investment in a business as a whole indicates an inefficient use of capital.

There are few formulas that show what the optimum use of capital should be. However, much valuable guidance may be obtained by comparing company ratios with industry ratios and by determining the reasons for unusual variances. An excellent selling tool for accountants to use in pointing out the unusual to management is a graph of company and industry ratios emphasizing trends as well as variances.

The caution sounded throughout this article should be re-emphasized now. Ratios are guides only. There may be perfectly good reasons why the company's ratios vary significantly from the published information. The important thing in the use of ratios is to be aware of the fact, when the company's figures are significantly different from the industry, and to determine the reasons for variance. Also, ratios are not to be used as a strait jacket. For example, it may be wise to build inventory if a material shortage is threatened or, in the expansion of a plant, it may be wise to build for the anticipated volume five years from now, even though, for the next few years, the fixed-assets-to-net-worth ratio may be out of line. However, the use of ratios does have its place and is an excellent guide for management's decisions.

Direct Costing—An Aid in Contract Profit Planning and Control

by KENNETH R. RICKEY

AS A TECHNIQUE OF CONTROL, direct costing can be applied to any type of business, and specifically to contract accounting with its marked differences from accounting for the repetitive production of products. Direct costing is dynamic and presents the true picture of a business operation. It is a technique easily understood by the nonfinancial executive because costs are separated by behavior as to volume and time, and are not intermingled so they lose their identity. Therefore, we should and can use it in costing and controlling contracts, either commercial or military.

Constituting the accounting, control and financial part of the management team of our respective companies, we have two broad, basic responsibilities to fulfill:

1. To provide the means and the advice to properly control the operations to meet the objectives of our respective companies.
2. To report the facts fairly to our shareholders and the public in a consistent, concise and conservative manner.

It is important that we understand these two basic responsibilities. The type of reporting can be different for each, even though the facts behind all of the reports must be the same in the books of account.

To this end let us examine an orderly, planned operation of a company engaged entirely in cost plus fixed fee and fixed price contracts and using the direct costing technique.

Planned Contracts and Costs

Our plan begins with a forecast of business for the coming year. The sales forecast must be validated with facts obtained through market research on our products and services within the markets we are capable of serving. Exhibit 1 is our forecast of sales and direct margin for the coming year by type of contract.

It is interesting to note that the direct-margin percentage varies, depending on the knowledge secured in making the market study. Also, the

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KENNETH R. RICKEY, Peninsula-San Jose Chapter (Chicago, 1946), was Controller and Chief Financial Officer of the Ampex Corporation, Redwood City, California, when this article was written. He has since formed the firm of K. R. Rickey Company. He was previously Vice President of Finance with Lenkurt Electric Company, San Carlos, California. Mr. Rickey was graduated from the University of Iowa with a B.S. degree. He is Past President of the Chicago Chapter. A previous contributor to the *Bulletin*, Mr. Rickey is a recipient of four N.A.A. Certificates of Merit.

SALES AND MARGIN FORECAST BY CONTRACT
FOR THE YEAR AHEAD

	Net Sales	Direct Margin	% Margin	% Allowable Period Costs
CPFF CONTRACTS				
ABLE	$ 1,200	$ 240	20%	10%
BAKER	3,600	540	15	8
CHARLIE	4,000	720	18	10
EASY	2,400	360	15	7
TOTAL CPFF	$11,200	$1,860	16.6%	8.7%
FIXED PRICE CONTRACTS				
ROLL	$ 2,000	$ 400	20%	10%
SOFT	8,000	2,000	25	10
TALL	14,000	3,080	22	10
TOTAL FIXED PRICE	$24,000	$5,480	22.8%	10%
TOTAL	$35,200	$7,340	20.9%	9.6%

EXHIBIT 1

allowable period costs are calculated after determining the profit margin we are willing to accept. This gives us our target for establishing expense budgets.

The next step is to establish a complete cost budget in a manner that will meet our company's objectives. This provides the standard against which the actuals can be compared for control. Exhibit 2 presents our cost plan for the coming year based on the sales and margin forecast in Exhibit 1.

In addition to the cost budget for the year, it is easy to "fold in" an inventory flow statement, which is most important in our control plan to meet our objective. It is essential that we have intimate knowledge of our materials, direct labor and variable burden, separately and by function. This information is readily available by contract from the time the bid is prepared until we have completed the contract. The bid will be prepared, based on our company objectives and will become the standard against which the actuals are compared on a periodic basis to

COST BUDGET
FOR THE YEAR AHEAD

	Costs For Year Ahead	Inventory Beginning of Year	Cost of Sales For Year	Inventory End of Year
DIRECT COSTS -				
Direct Materials	$12,500	$ 4,800	$11,100	$ 6,200
Direct Labor				
Engineering	2,500	1,300	2,700	1,100
Manufacturing	6,000	2,500	5,630	2,870
Total Direct Labor	$ 8,500	$ 3,800	$ 8,330	$ 3,970
Variable Burden				
Engineering	2,300	1,200	2,500	1,000
Manufacturing	4,900	2,100	4,660	2,340
Contract Administration	1,100	500	1,070	530
Accounting	200	100	200	100
Total Variable Burden	$ 8,500	$ 3,900	$ 8,430	$ 3,970
Ratio to Direct Labor	100%	102.6%	101.2%	100%
Total Direct Costs	$29,500	$12,500	$27,860	$14,140
PERIOD COSTS -				
Engineering	310			
Manufacturing	826			
Contract Administration	710			
Finance & Accounting	550			
General Administration	980			
Total Period Costs	$ 3,376			
Ratio to:				
Sales	9.6%			
Total Direct Costs	11.4%			
UNALLOWABLE COSTS -				
Interest	$ 100			
Entertainment	50			
Total	$ 150			

EXHIBIT 2

check on our progress. (Exhibit 1 is set up using current backlog and bid proposals that are expected to be delivered during the year; therefore, much of it is a known quantity and far from guesswork.)

The cost plan for the year is also detailed by contract. The beginning inventory, by contract in process, is compared with known contracts in the backlog to be produced during the year. This forms a base consisting of the operations that are certain to take place. Direct materials, direct labor and other expenses are planned for these known contracts at a level that will produce a profit and preclude our building any excess inventory.

The next step is to include other contracts that our market research indicates we must plan for during the year. These are added in such a way that we will know the effect on our operation if we do not receive them, and know it in time to take corrective action to maintain our profit margin.

A brief comment on costs in the order in which they are shown on Exhibit 2 will be helpful at this point. The direct cost plan under which we operate separates direct materials, direct labor and variable burden by contract for the current year. It keeps them separated through the inventory and cost of sales accounts. With this kind of information we always know the trend of our costs in relation to each other and particularly the variable burden ratio to direct labor. Period costs do not have any direct relationship to the items being sold under contract. In any type of operation, these items of expense bear a particularly close watch because there is a tendency to neglect them in favor of what appear to be more important items. Unallowable costs are bitter pills in the contract business, but if we know they will exist, it is better to plan them than to be surprised.

It goes without saying that there are many detailed budgets behind the costs shown in Exhibit 2, such as the material purchase plan in detail by contract compared to inventories, the direct labor manning table, the equipment, tooling, expense budgets, etc.; these represent the detailed planning summarized in our overall direct cost plan.

RESULTS OF OPERATION
FOR THE YEAR AHEAD COMPARED TO LAST YEAR

		Year Ahead		Last Year	
		Dollars	% to Sales	Dollars	% to Sales
	Orders Received	$42,240	120%	$36,200	121%
	Backlog - end of year	25,000	71%	17,960	60%
	Breakeven Point	$16,870	-	$15,995	-
	As a % of Sales	-	48%	-	54%
1*	Net Sales	$35,200	100.0%	$29,800	100.0%
	Direct Cost of Sales				
2*	Direct Materials	11,100	31.5	9,565	32.1
2*	Direct Labor	8,330	23.7	7,150	24.0
2*	Variable Burden	8,430	23.9	7,240	24.3
	Total Direct Costs	$27,860	79.1%	$23,955	80.4%
1*	Direct Margin	$ 7,340	20.9	$ 5,845	19.6
2*	Allowable Period Costs	3,376	9.6	2,955	9.9
		$ 3,964	11.3%	$ 2,890	9.7%
2*	Unallowable Costs	150	.5	180	.6
	Operating Profit Before Taxes	$ 3,814	10.8%	$ 2,710	9.1%
	Income Taxes	1,983	5.6	1,410	4.7
	Net Earnings	$ 1,831	5.2%	$ 1,300	4.4%

* Exhibit from which figures are taken.

EXHIBIT 3

The Final Plan

To complete our results and set up an operation plan for the coming year, we need only the orders received forecast. It is available, as our sales and margin forecast (Exhibit 1) could not have been prepared without it. Exhibit 3 presents this plan, which includes comparison with actual results for the past year. With this tabulation, we can immediately compare our current plan with the results of the period just finished. With our beginning backlog of $17,960, one half of our forecast sales, we can feel some degree of confidence in our plan. The break-even point is just slightly above (5 percent) last year's actual; however, as a percent to the sales volume, it is down over 10 percent because of a planned increase in sales over last year. It is comforting to note that our planned break-even point of $16,870 is lower than our beginning backlog. This important indication—the break-even point—is available because of our direct costing technique and is easily computed directly from the statement ($3376 + 150 ÷ 20.9 percent).

We relate our direct cost elements to the sales dollar and compare them with last year to find the trend of each element and our direct margin. As an example, if our plan showed a rising trend in the direct material content, we want to examine this in some detail, as it is through "our know how and conversion" by labor and facilities that we earn our profit.

Profitable Contract Lost; Quick Adjustment Possible

Earlier we mentioned that our direct costing technique permits us to know the effect of failing to obtain a contract that we had in the plan. Let us illustrate this by an example:

Assume that a fixed price contract in Exhibit 1 of $8,000 in sales and $2,000 in direct margin does not materialize. The question is what effect will this have on our plan for the year if it is not replaced by another contract? By using the major items in Exhibit 3, the effect can be quickly computed:

	Current plan	*Revised plan*
Break-even point	$16,870	$17,990
Net sales	$35,200	$27,200
Direct margin	$ 7,340	$ 5,340
% to sales	20.9%	19.6%
Period costs (allowable and unallowable)	$ 3,526	$ 3,526
% to sales	10.0%	13.0%
Operating profit before taxes	$ 3,814	$ 1,814
% to sales	10.8%	6.7%
To hold break-even point at $16,870, period costs ($3,526) must be reduced by 19.6% of $16,870 to		$ 3,306

It is very important to note that this calculation can be done immediately —in a manner of minutes while we

are in conference with the president, and marketing, manufacturing and engineering directors. We can even do it on a blackboard so they can follow it. Without the direct cost technique, we would have to plead for time to make the computation.

What can we do to bring our direct margin back up? The lost contract was more profitable than the others. What action can be taken with period costs to reduce them by $220 to at least hold our break-even point of last year—$16,870? Such a reduction would raise our operating profit before taxes from $1,814 to $2,034, which is 7.5 percent of sales—still a drop of 30 percent from the planned 10.8 percent operating profit. With the break-even point the same, at $16,870, it is 62 percent of the new sales volume of $27,200, at a point where it may be above our high limit in relation to sales volume.

This is only one simple example of how the direct costing technique as applied to contracts can enhance the value of the accountant as a part of the management team. We can react on the spot. Action can be taken before an event takes place, in time for us to do something about it to meet our company's objective. Just as we make plans for the future, we must continuously recheck these plans and make sure they will happen the way we planned them. In this way, the comparison of the results against the plan will be confirmation of the working out of a management-planned course of events.

Direct Costing Provides the Action Facts

This is one demonstration that direct costing is a dynamic technique. It permits management to review a course of action before it takes place. In contract work, if we think for a minute that we can permit a period cost rate to rise from 10 percent to 13 percent of sales just because we lose one contract, we are doing some wishful dreaming. We had better know about it before it happens and take action to correct it or else our profits will suffer just as indicated in our example.

Competition gets keener each day. The company that has a day's jump on its competitors will reap the rewards. Direct costing in contract accounting will help provide quicker information for better decisions.

Capsule or Machine Hour Costing

by JACOB SCHMIDT

A CAPSULE may be defined as a "small case or sheath." The word has general and similar meanings in the scientific fields of anatomy, biology and chemistry. It would seem to be very apt to apply it to machine hour rates used in the field of cost accounting for, in many respects, these rates are like capsules.

The use of machine hour rates by a cost accountant is analogous to the use of a capsule by a pharmacist in filling a prescription. In much the same manner, the cost accountant analyzes the cost incurred in operating the individual production centers of a machine shop and encloses them in figures by developing standard machine hour rates for each center. He makes these rates available to cost estimators and cost clerks for the performance of their costing functions in the most facile manner.

To be sure, the cost accountant's task is considerably more difficult than that of the pharmacist in that he has to do more than interpret a prescription, use measuring instruments such as scales and graduated cups, mix the various substances in a mortar bowl, and compress the resultant mixture into a gelatine capsule. While the pharmacist relies primarily on technique, the cost accountant depends mainly on the use of keen analysis and judgment in the compilation of standard machine hour rates. His insight into the behavior of manufacturing costs as influenced by fluctuations in volume of activity is fundamental in the derivation of machine hour rates which, when applied to the hours of activity in the respective machine centers, will provide for the absorption of all labor and burden costs of the plant when operating at the forecasted normal volume on which the rates were predicated.

Development of Machine Hour Rate

What is normal volume? It is usually a consensus arrived at by executives and the heads of sales and operating organizations, limited, of course, by the physical plant capacity expected to be available for production during the year for which the machine hour rates are going to be developed. Optimum use of all facilities would dictate a three-shift operation if there was sufficient demand for the product.

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Assuming that plant facilities will not be increased significantly, the number of shifts to be employed will be dependent upon anticipated sales volume and the present practical capacity of the plant when run on a single-shift operation. Determination of practical capacity results from summation of the hours it is expected each machine will be run, after taking into consideration theoretical capacity and deducting anticipated down-time occasioned by machine breakdowns, employee absenteeism, interruption in the flow of materials to the machine, etc. All of these variable factors affecting practical capacity can be predicted, with a reasonable degree of accuracy, by studying factual records reflecting past experience and by exercising sound judgment. Once the practical capacity of the individual machine centers and the number of shifts these centers are going to be operated have been determined, it is a simple task to compute the normal machine hours per annum for each machine, machine center, department, and the entire plant. In fact, from a mechanical standpoint, the entire development of a set of machine hour rates is done with ease.

The complexities are involved in deriving complete and authentic data from many sources and molding the data into such form that they can be incorporated easily into the machine hour rate structure. The most fruitful source of data is the plant ledger in which the costs of operating the entire plant should be recorded monthly by department in adequate detail. The data should be in such form as to readily permit further analyses and redistributions of costs which might be required to determine more meticulously portions ascribable to each machine center.

As an aid in making finer accounting distributions, it will be necessary to keep auxiliary records for recording significantly large dollar items of cost by machine center as well as by department. For example, the incurred cost of cutting tools should be kept by machine centers as well as by department number so that this relatively large element can be assessed directly against a specific center, rather than pooled with like costs pertaining to other machine centers in the same department and then allocated on a formula or judgment basis.

However, since, in many instances, such allocations are necessary from a practical standpoint, it is imperative that records be maintained which will provide currently the following basic data needed to allocate expenses to centers:

1. Space occupied by each center.
2. Value of equipment in each center.
3. Horsepower rating of electric motors installed on machines in each center.
4. Actual hours of individual

machine activity for use in computing *variable* cost per machine hour.

5. Normal hours set for each center to be used in computing *fixed* cost per machine hour.

The setting of the rates should be correlated with the preparation of the plant budget. Whether historical or current, all data must be adjusted to reflect anticipated operating conditions and costs at a normal level of activity during the fiscal year for which the machine hour rates are to be used. As in the case of preparing a flexible factory budget, the proper development of standard machine hour rates requires that, to the extent feasible, all costs be segregated as between fixed and variable categories, in order that those costs which are a function of time can be divided by *normal* hours and those which are a function of activity can be divided by *actual* hours for the purpose of computing the individual values of the various cost elements which will be incorporated into the standard machine hour rate structures. A good classification of accounts facilitates the separation of costs as between the fixed and variable classifications in that the split can be made often on the basis of the account title alone. Those account titles which suggest that the costs so classified are semi-variable in nature, call for special analyses or the use of a regression formula to aid in effecting the desired separation.

An Example of Cost Center Rate Computation

Upon completion of all required analyses, it will be practicable to summarize the total budgeted annual costs for the plant, operating at normal capacity as follows:

	Fixed	*Variable*	*Total*
	(Thousand dollars)		
A. Costs identified with specific centers	$ 720	$4,800	$5,520
B. Costs identified with specific department but not with any particular center within the respective department	360	3,000	3,360
C. Costs applicable to all centers but not to any specific department or center	240	480	720
Total factory budget—Plant No. 2	$1,320	$8,280	$9,600
Normal machine hours (in thousands)	$1,200	$1,200	$1,200
Average cost per standard machine hour	$1.10	$6.90	$8.00

Continuing with the illustration, the steps for developing the rate for Machine Center 511-30 will be outlined. The last two digits in the number indicate that the center is located in Department No. 30, Engine Lathe, Plant No. 2. Utilizing the available detailed data which has been categorized as indicated by Items A, B and C in the factory budget shown above, a standard machine hour rate of $8.40 was developed, as indicated by the following rate structure:

Cost Element	*Per Standard Machine Hour* *Fixed*	*Variable*	*Total*
Costs identifiable with machine center			
Direct labor	$ –	$3.00	$3.00
Indirect labor	.20	.60	.80
Sub-total	$ .20	$3.60	$3.80
Labor appendage costs—25%	.05	.90	.95
Perishable tools		.30	.30
Shop supplies		.05	.05
Electric power		.20	.20
Depreciation of machinery	.20		.20
Personal property taxes and insurance	.05		.05
Occupancy	.10		.10
(Other Items)			
Dept. 30 expense not identifiable with specific machine centers—allocable to all centers	.30	2.00	2.30
General factory expense not distributed to machine centers or departments—allocable to all machine centers in Plant No. 2	.15	.30	.45
Totals	$1.05	$7.35	$8.40

The ensuing pertinent comments relative to each cost element are briefly explanatory:

Direct labor. In this instance, the amount of $3.00 is the maximum rate of pay stipulated in the union contract to be paid to the operator running this type of machine alone. Were this a center in which the operator used two machines simultaneously, the direct labor cost per standard machine hour would be $1.50, or one-half the amount applicable to a machine center with a single machine complement.

Indirect labor. Included under this caption would be maintenance of tools and equipment; the fixed expense portion represents the cost of preventive maintenance which would be incurred even though the machine were inactive.

Labor appendage costs. Included under this category would be:

1. F. I. C. A.
2. Unemployment insurance
3. Group life insurance
4. Workmen's compensation and public liability insurance
5. Pension and severance costs

Admittedly it is a difficult task to compute a composite rate which, when applied to total wage payments to shop personnel, will equal the aggregate cost of these related items. In many instances there is no true correlation of the appendage cost with the labor cost; nevertheless, with due diligence and an adequate knowledge of the behavior of these costs, the factor can be computed with a desirable degree of accuracy.

Perishable tools. These consist of:

1. Cutters
2. Unemployment insurance
3. Broaches
4. Drills
5. Diamond wheels
6. Grinding wheels

Technical data obtainable from the machine tool manufacturer, together with information obtained from auxiliary records kept on the hours of service and cost of particular tools used in running certain machines, would be the best source of facts for computing machine center cost per hour which must be provided for in the machine hour rate structure to recover the cost of tooling incurred.

Shop supplies. A clear distinction must be made between two types of shop supplies:

1. Those of relatively high cost used only in one or two of many centers within the department.
2. Those of a general nature which are used more or less in every center within the department.

Only those in the first category are included in the $.05 per hour variable cost for this particular center. These in the second category are included in the allocation of Department 30 expense to all centers in the department.

Electric power. Theoretically, the demand charge portion of the electric bill should be treated as a fixed cost. From a practical standpoint, however, it was deemed preferable to forecast a composite rate per horsepower hour, embracing both the demand and consumption portions of the electric bill. Since the connected load of Machine Center 511-30 is twenty horsepower and a rate of one cent per horsepower hour was forecasted, a variable cost of twenty cents per standard machine hour was derived.

Depreciation. The annual depreciation cost scheduled to be charged against one or more machines in a particular center, divided by the number of normal machine hours established for that center, produces the applicable cost per standard machine

hour. In the example, this is twenty cents.

Personal property tax and insurance. The computation of this element of cost is based on the value of the machinery and equipment in each machine center as related to the respective normal machine hours.

Occupancy. The total building expense applicable to the areas associated with the machine centers, divided by the square footage of all centers and divided further by the total normal machine hours for the plant, must be multiplied by the square feet of area occupied by the individual center to obtain the cost per machine hour. In determining the square footage of a machine center, the area needed to serve these machines, such as a place for stacking materials for the operator and an allocation of aisle space serving the center, should be taken into account.

Department 30 expense not identifiable with specific machine centers. Except in a few instances where a pro rata distribution of Department 30 general expense would be inequitable, the fixed expense of $.30 and variable expense of $2.00 would appear in the rate structure of each center located in Department 30. Bear in mind that the departmental expense to be apportioned would include the expenses previously distributed from such service departments as production control, inspection, purchasing, cost accounting, tabulating and payroll, personnel and medical, etc., if these departments are not treated as Plant 2 general expense.

General factory expense not distributed to departments or machine centers. With the possible exception of perhaps a few cases in which deviations are appropriate, the same figures, namely $.15 fixed expense and $.30 variable expense, would be used in developing the rates for each center in Plant No. 2.

Effective Use of Machine Hour Rates

Now that the machine hour rates have been predetermined and the hourly labor and burden costs generated by the operation of each productive machine center have been compressed into capsule form, how are these rates going to be used effectively? First of all, they are going to be used in setting the standard labor and burden cost of a standard product or a special job, by evaluating each of the operations stipulated in a shop routing that shows the performance sequence and designates the machine center in which each operation shall be done. The routing further shows the number of hours (to the nearest tenth) it is expected that the operator will take to set up the machine to do the operation, as well as the number of hours (to the nearest hundredth) the operator should take to run each piece. For example, the standard cost of $2.87 set

EXHIBIT 1

Standard Cost of Manufactured Part

Part No. 674084

Machine center Number	Machine center Rate	Hours Setup	Hours R.T.E.*	Setup cost Gross	Setup cost Each	R.T.E.* cost	Cumulative cost each	Operation number
62732	0765	1.50	.025	$11.48	$ .68	$ .19	$ .87	2
76839	0955	.50	.080	4.78	.28	.76	1.91	3
98946	0675		.030			.20	2.11	4
95946	0980		.025			.25	2.36	5
42349	0915		.025			.23	2.59	7
98946	0675		.015			.10	2.69	9
41543	0820		.010			.08	2.77	10
41643	0685		.005			.03	2.80	11
41743	0665		.010			.07	2.87	12
Totals		2.00	.225	$16.26	$ .96	$1.91		

* Running time each

EXHIBIT 2

Summary of Machine Activity

Week End. 2-25-61
Period 4 Year 1961

Date Mo.	Day	Yr.	Plant & dept.	Machine Cent.	No.	Rate	No. of cards	Actual hours	Standard hours	Act. lab. & burd.	Std. lab. & burd.	Direct labor hrs.
2	21	1	230	501	01	11.95	22	103.5	63.0	$1236.86	$ 752.88	103.5
2	23	1	230	510	01	8.55	5	31.0	18.6	265.05	159.03	31.0
2	20	1	230	511	09	8.40	7	27.5	20 8	231.00	174.72	27.5
2	22	1	230	516	07	8.20	12	34.3	31.0	281.26	254.20	34.3
2	23	1	230	516	09	8.20	3	5.3	3.6	43.46	29.52	5.3
2	22	1	230	529	01	8.50	10	47.9	42.1	407.15	357.85	47.9
								* 746.2	588.1	$6618.41	$5148.16	

for Part No. 674084 having a standard lot size of 17 would be compiled as shown in Exhibit 1. (Close scrutiny will reveal that operations numbered 1, 6 and 8 are missing, the reason being that these operations are done by labor classified as indirect labor; such labor is absorbed in the related machine hour rates.)

Not only is this standard cost sheet prepared by the cost and tabulating departments for the use of the estimating department in connection with making quotations and helping to set prices of standard products; it is also for the use of the cost department in costing:

1. Shipments
2. Spoiled work scrapped
3. Annual physical inventory

The total gross setup cost figure enables the cost estimator or the cost accountant to revise the cost of a manufactured part quickly when a change in the lot size is contemplated. If, in the illustration, the lot size were changed from 17 to 34, the amount of of $16.26 would be divided by 34 and the setup cost would be $.48 instead of $.96, thus reducing the cost of Part No. 674084 from $2.87 to $2.39 each.

The cumulative cost shown at various stages of production is indispensable for the purpose of costing out work in process being scrapped or inventoried.

In conformity with the desirable practice of integrating cost and financial data, machine hour rates are used both by the cost department to determine what portions of the total labor and burden should be applied to the various products and jobs and by the general accounting department to accumulate a total applied labor and burden cost to determine to what extent these costs, as incurred for the period were recovered, and the amount of over- or under-absorption. Accordingly, machine activity summary reports are prepared periodically as illustrated in Exhibit 2, which shows the weekly summary for one department. The same summary is prepared for every department in the plant from the same source as that used for the accumulation of product and job costs, namely, the daily job tickets which record the activity of every operator.

The column in Exhibit 2 headed "Act. Lab. & Burd." has recorded in it the *actual* hours of machine operation multiplied by the respective standard machine hour rates, whereas the column to the right shows the corresponding *standard* hours of output as computed by evaluating the number of pieces produced on the basis of the standard setup and running time specified in the production routings released to the shop. Standard time is determined by time study, rating tables, and past experience. Since the source data are the same, the total labor and burden costs accumulated by

product codes equal the similar total derived by striking a monthly total of the summary-of-machine-activity reports for each department.

Whatever variance in absorption of labor and burden occurs is attributable to two principal reasons:

1. The deviation of actual hours from normal hours.
2. The incurrence of labor and burden costs over or under the budgeted cost.

Referring back to the earlier illustration showing the budgetary content of a projected average standard machine hour rate of $8.00, assume the following accounting results for the month of March:

Actual incurred labor and burden	$692,000
Applied labor & burden—80,000 actual machine hours at an average rate of $8.05 per hour	644,000
Underabsorbed labor and burden	$ 48,000

Consisting of:

1. Fixed costs not absorbed owing to failure to produce at normal capacity—100,000 hours		
Actual	80,000 hours	
Under	20,000 hours @ $1.10	$ 22,000
2. Costs incurred in excess of budget		26,000
		$ 48,000

No matter what cost analyses or applications are made, it is definitely easier to accumulate labor and burden costs by multiplying machine hours by respective machine hour rates and summarizing the extended amounts than to make the accumulation in the conventional way, that is, by:

1. Multiplying direct labor hours by hourly labor rates.
2. Selecting and applying the related departmental burden rate.
3. Applying a material handling rate to cost of material consumed.
4. Applying a general factory overhead rate.
5. Adding the first two, three, or four results together, depending upon the number of burden rates used in costing product and absorbing direct and indirect costs.

By comparison with the method employing machine rates, the conventional method of costing is cumbersome and inefficient. Should the use of machine hour rates become more widespread because of belated recognition of the advantages gained through such use, it would not be surprising if the trend toward the preference of machine hour rates as a unit of measure in the cost accounting profession will be as pronounced as the recent trend toward compact cars in the automotive industry.

DDB or SYD—Which "Recovers" Depreciation More Rapidly?

by JOHN E. GRAVES*

SINCE the Internal Revenue Code of 1954 was written, taxpayers have been faced with the problem of determining which of the two accelerated methods of accruing depreciation prescribed in Section 167 of the code is more advantageous. A cursory investigation of the problem has led many taxpayers to the incorrect conclusion, namely, that use of the double-declining balance method results in a more rapid recovery of money originally expended than use of the sum-of-the-years'-digits method. Calculations, illustrated by an example with this paper (Exhibit 1 shows that the double-declining balance method should be used only for assets having expected useful lives of 5.7 years or less. Use of the sum-of-the-years'-digits method allows the taxpayer a more rapid recovery of money when applied to assets with lives of 5.8 years or more. (Expected scrap value in this example is assumed to be zero.)

These points should be made initially:

1. Use of the DDB method always gives a higher depreciation write-off than use of the SYD method during the first year of an asset's life. This fact has undoubtedly led many taxpayers to believe that its use results in a faster overall recovery, which can be demonstrated to be false.

2. The use of DDB never allows the taxpayer to recover the total original cost of the asset being depreciated. This is theoretically true, but the Internal Revenue Code of 1954 has provided against this problem quite adequately, as follows:

"¶1.167 (e) *Statutory provisions; depreciation; change in method*

—1 *Change in method*

——(b) *Declining balance to straight line*

In the case of an account to which the method described in section 167 (b) (2) [DDB] is applicable, a taxpayer may change without the consent of the Commissioner, from the declining balance method of depreciation to the straight-line method at any time during the useful life of the property. . . ."

Any comparison of SYD and DDB, therefore, must be a comparison of SYD and DDB converted to straight-line at the time when it is in the taxpayer's best interest, i.e., when the accrual using a straight-line rate exceeds that derived from the DDB rate. If the change from DDB to straight-line were not permissible, SYD would be preferable to DDB in all cases, since these accelerated methods are applicable only to property with a useful life of three years or more; the use of SYD results in faster recovery of money than DDB (without changing to straight-line) for three-year-lived property.

A dollar recovered today is more valuable than one recovered next year. The simplest way to measure the present worth of future monies is to apply compound discount factors to each future recovery. In this illustration, a 3 percent rate is used; this rate closely approximates the real cost (after taxes) of borrowed money.

It will be noted on Exhibit 1 that a present-value factor of 1.0000 is used for the initial year of the asset's life. Because income taxes are payable in four installments, two of which fall due within the current year and two during the following year, this computation is slightly oversimplified. However, a more precise computation, using factors exactly aligned with income tax payments, would not affect the results of the computation shown.

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EXHIBIT 1

Comparison of Double Declining Balance and Sum-of-the-Years'-Digits Methods of Computing Depreciation Accruals

		Sum of the Years'-Digits Method			Double Declining-Balance Method			Difference Between Methods		
		Unrecovered Cost	Depreciation Rate	Accrual	Unrecovered Cost	Depreciation Rate	Accrual	Difference in absolute dollars	Present value factor at 3%	Difference in real dollars
Useful life of 5.7 Years										
Year	**Remaining Life**									
1	5.7	$100.00	.2969	$ 29.69	$100.00	.3509	$ 35.09	$(5.40)	1.0000	$(5.40)
2	4.7	70.31	.3481	24.47	64.91	.3509	22.78	1.69	.9709	1.64
3	3.7	45.84	.4205	19.28	42.13	.3509	14.78	4.50	.9426	4.24
4	2.7	26.56	.5296	14.06	27.35	1/2.7	10.13	3.93	.9151	3.60
5	1.7	12.50	.7083	8.85	17.22	1/1.7	10.13	(1.28)	.8885	(1.14)
6	0.7	3.65	1.0000	3.65	7.09	1.0000	7.09	(3.44)	.8626	(2.97)
				$100.00			$100.00	$ -0-		$(.03)
Useful life of 5.8 Years										
Year	**Remaining Life**									
1	5.8	$100.00	.2929	$ 29.29	$100.00	.3448	$ 34.48	$(5.19)	1.0000	$(5.19)
2	4.8	70.71	.3429	24.25	65.52	.3448	22.59	1.66	.9709	1.61
3	3.8	46.46	.4130	19.19	42.93	.3448	14.80	4.39	.9426	4.14
4	2.8	27.27	.5185	14.14	28.13	1/2.8	10.05	4.09	.9151	3.74
5	1.8	13.13	.6923	9.09	18.08	1/1.8	10.04	(.95)	.8885	(.84)
6	0.8	4.04	1.0000	4.04	8.04	1.0000	8.04	(4.00)	.8626	(3.45)
				$100.00			$100.00	$ -0-		$ .01

The exhibit demonstrates only the depreciation deductions on a $100 asset using the two prescribed accelerated methods. It does not compute the tax effect. Since the tax rate is the same in either case, the further computation of tax savings or deferrals is not necessary for the purpose of this demonstration. The SYD depreciation rates are taken from Table 1, Section 167 of the 1954 Code and are applied to the unrecovered cost to produce each year's accrual. The DDB rates are arrived at by doubling the reciprocal of the asset's life. The straight-line remaining life method is used to accrue depreciation in the fourth year and following years of the asset's life in both illustrations, since the depreciation accrual resulting is greater than the accrual resulting from continued application of the fixed DDB rate to the remaining unrecovered cost. As has been stated, expected scrap value in this illustration is zero. Computations similar to those shown here should be made to determine the "cross over point" of DDB and SYD if scrap value is considered. Since the SYD method gives consideration to scrap value whereas the DDB method does not, the "cross over point" will vary significantly if scrap value is a major factor.

It is hoped that this paper will afford some guidance in determining which method of accelerated depreciation to use for tax purposes. There is no reason why every taxpayer should not derive maximum benefits from the provisions of the Internal Revenue Code concerning depreciation. To obtain such benefits taxpayers should use the SYD method in computing depreciation for all assets except those with short lives or high scrap value.

Finding, Screening and Appraising New Products

by NUELL P. STEINMETZ and DOUGLAS D. DODD

THE MOST ESSENTIAL requirement for any manufacturer of industrial goods hoping to stay in business is an adequate and continuing flow of new product ideas. We have seen annual reports of firms that have stated that 65 percent of their sales volume is from products which were nonexistent only five years ago. One need only look at the fantastic growth of manufacturers of transistors or to the drug industry to see very convincing evidence in support of the tremendous impact of new products on our total economy. Not all companies can boast of a high ratio of completely new products. However, a review of your own product line will probably show that even the oldest item in your line has been changed one way or another since 1955.

Micro Switch Division manufactures what is generally known in industry as precision snap-action electrical switches. The unique feature of the device is its ability to switch 15 to 20 amperes at 125, 250 or 460 volts AC within the confines of a relatively small package. The total travel of the moving switch contact varies from .010" to .070" in most of our standard catalog items. Rather high energy electrical circuits are being made and broken with a minimum of movement. The product line ranges from the sub-subminiature switch which weighs one twenty-eighth of an ounce and takes up about as much space as the eraser on the end of a pencil, to our explosion-proof heavy duty limit switches, some of which weigh 7 or 8 pounds.

The Idea for a Better Product

Let us consider the limit switch field. This type of switch has been offered for sale by several manufacturers for many years. A limit switch should be small but rugged. Usually, it must take considerable physical abuse. Similarly, it must be accurate—repeatability must be within very narrow limits. It should be able to perform from 1

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to 10 million operations without failure, in an environment that might include cutting oil or abrasive materials. It must operate in coolant liquids which will be stone cold at start-up on a Monday morning but might come close to the boiling point during the rest of the week.

Many improvements have been made in limit switches over the years. "O" ring seals, oil resistant neoprene gaskets, to name two, are decided improvements. However, limit switches still fail occasionally! In some plants there are literally hundreds of die-cast limit switches on automated transfer lines. One switch failure shuts down the entire line. When that line shuts down, confusion results. All the plant manager can see is the burden rate reaching astronomical proportions because of downtime. The field engineer has found many causes for failure —excessive moisture, bad cam design which permitted fast snap-off and, indeed, some switches had been worked to death with in excess of 15 to 20 million operations.

The resulting downtime is the worst feature of a failure. A top-notch electrical maintenance man should be able to change any of the more popular makes of limit switches promptly. Twenty minutes is about par for the course, but twenty minutes is too long. Reports began to come in from the field that there was a need for a limit switch which could be quickly replaced. Eventually, someone said "plug-in," and the idea was born. Here was a case of products doing a good job but needing an improvement which would avoid costly downtime at the end of their service lives. A switch had to be produced which would be a plug-in unit, yet retain all of the moisture-proof, long life and repeatability features of what then was a standard limit switch. A new product was "found" by having switch users tell our field engineers that they needed something to reduce downtime.

Screening the Idea

However, so far, all that had been found was the idea, namely, "downtime is very costly . . . a plug-in limit switch is needed." This sounded like a sure winner, but any newly found concept should be run through the "wringer" to determine what might happen in the market place. In spite of the fact that more and more industries are doing a screening job on new products, there is still a very unfavorable ratio of failures. It has been reported that 4 out of 5 new products introduced by 200 large, well-managed companies failed to return a profit—ever! Obviously, it is up to top management to screen out the product which has little chance for success so that the dollars can be spent on something else which stands a better chance to produce an acceptable return on investment.

In our case, the screening and appraisal is done in several interrelated

steps. All new product ideas are brought before the new product planning committee. This committee is made up of the general manager, two

SALES PROJECT DATA SHEET

Industry_____ Office_____ Customer_____

Customer Product_____ By_____ Address_____

Micro Product_____ Date_____

Remarks_____ Contact_____

1. DESCRIPTION OF PRODUCT AND MARKET

Briefly describe the product being proposed.
Discuss any unique features.
Describe possible applications, the type of equipment on which it would be applied and the function of the equipment.
Discuss the types of customers constituting the potential market and the industry classifications represented.
Discuss the range of usage of the product and any restrictive factors.

2. SALES DATA

Volume - What is potential volume? Immediate, future, when?
Will this displace or reduce volume of any existing product?
Price - Discuss acceptable range on selling price, including list, low net and applicable discount structure.
Competition - Discuss existing competition on this product, including other methods of accomplishing function of switch, effect product will have on competitors, desirability of design that will afford patent protection and the probability of the product being copied.
Marketing - Does this product involve any unusual sales or distribution problems? Can it be handled by our regular sales organization? Authorized Distributors?
Timing - Discuss sales goals and tentative date for introduction of this product.

3. TECHNICAL DATA

3.1 Product Requirements - List specific details of product required, such as dimensions, characteristics, tolerances, circuit arrangements.
3.2 Application Conditions -
Electrical - Discuss desired electrical capacity with supporting reasons - include anticipated duty cycle.
Detail any unusual electrical features.
Mechanical - Discuss typical and extreme conditions in method, rate and frequency of actuation.
Describe environmental conditions which switch must withstand.
3.3 Performance Requirements - Indicate requirements for electrical and mechanical life.
Discuss inspection agency requirements (UL, MIL, etc.) and list any performance specifications to which switch must conform.
Describe any unusual functional, test or life requirements.

4. SALES PROGRAM ACTION REQUIRED

Describe in detail the steps that will be taken to successfully market the product.
Indicate the action that will be taken by Sales and that required from other groups. Show time table.
Request specific action from Product Research or Engineering, or both, to develop or design a new product or to modify an existing product.
Specify time schedule.

EXHIBIT 1

vice-presidents, controller, director of engineering, sales manager, patent attorney, factory manager and the manager of marketing. The last named, or his staff of market sales managers, usually presents all of the available information about the proposed item. The purpose of this presentation is to determine whether or not the concept is within the generally defined limits for inclusion in our product line and if there is some indication of a market for such a device.

Assuming the concept is cleared by the committee, the next step is assignment of the project to a market sales manager. Each of these specializes in sales to particular industries. For example, one man is responsible for sales to vending and appliance manufacturers, while another has aircraft and missile producers within his jurisdiction. The assignment to the market manager is specifically to prepare a sales project (Exhibit 1). This is not something that can be accomplished overnight. It calls for a lot of information. First of all, it describes the new idea in detail. Second, it includes the all-important sales data section. Considerable time and effort are required to secure forecasts of annual sales by units for the first three years. A target price must be established. Some evaluation of competition must be made and the timing schedule established. Many sources are used in the accumulation of these data—market research, the field sales organization, the experience of division executives, to name only a few. Besides sales data, technical data must be supplied. The electrical capacity, mechanical and electrical life requirements, size and configuration of the device and the environment in which it must operate, all need to be known.

In the case of the plug-in limit switch, it was possible to secure direction from the field. The market research department, along with the market sales manager, conducted a field survey using a technique of open-end interviewing. Prospects in the machine tool, conveyor and materials handling industries were contacted. An artist's conception of the proposed device was used, inasmuch as a prototype had not been produced. Obviously, a sample switch would cost a considerable amount. The researcher was able to explain to prospective users what was intended by using a drawing showing the unit assembled, another showing the two parts of the switch housing separated, and finally an exploded view of the whole plug-in assembly in what was thought might be the actual size. When twelve interviews had been completed, a look was taken at the answers received. Some common requirements were starting to emerge. A couple of minor changes in interview technique were made and other prospective users were contacted.

In conducting market surveys of industrial products using qualitative

rather than quantitative study procedures, forty to sixty interviews are usually sufficient. The study was continued to a total of sixty interviews and the results analyzed. A report was made to the market manager responsible for the project. He used the research data in preparation of the sales project form. Information was provided on selling price, electrical requirements, mechanical features, size and shape which it was felt would be most acceptable.

Appraising the Proposed Product

Before any new products can be approved, top management has to establish goals which all new products

PROJECTED PROFIT and LOSS STATEMENT
(FOR A NEW PRODUCT)

PROJECT NO.
SCHEDULE
DATE

TITLE _____

LINE NO.		19___ AMOUNT	19___ PER UNIT	19___ AMOUNT	19___ PER UNIT	19___ AMOUNT	19___ PER UNIT	TOTAL AMOUNT	TOTAL PER UNIT
1.	NUMBER OF UNITS								
2.	SALES								
3.	COST of SALES:								
4.	*MATERIAL*								
5.	*DIRECT LABOR*								
6.	*FACTORY EXPENSE*								
7.	TOTAL								
8.	FACTORY PROFIT								
9.	% TO SALES	%		%		%		%	
10.	ENGINEERING EXPENSE								
11.	GROSS PROFIT								
12.	% TO SALES	%		%		%		%	
13.	EXPENSES:								
14.	SERVICE ENGINEERING								
15.	*BRANCH*								
16.	*ADVERTISING*								
17.	*HOME OFFICE*								
18.	TOTAL								
19.	ADMINISTRATIVE								
20.	TOTAL								
21.	NET PROFIT *BEFORE* TAXES								
22.	% TO SALES	%		%		%		%	

COMMENTS:

EXHIBIT 2

must meet. Some companies will not consider any new product which has a return on investment less than 20 percent. The product life cycle is important. A five-year minimum is the criterion for many companies (which would rule out the hula-hoop).

The sales project sets other procedures in motion. Cost estimates are made covering engineering, tooling, product costs and advertising. These estimates form the basis for a projected profit and loss statement and investment statement for the new product as illustrated by Exhibits 2 and 3. The controller's department compiles this data for submission to the executive committee. It is felt that new products are a vital part of the business and, therefore, are a top manage-

PROJECTED INVESTMENT
(FOR A NEW PRODUCT)

PROJECT NO.
SCHEDULE
DATE

TITLE _____

LINE NO.		19__ AMOUNT	19__ AMOUNT	19__ AMOUNT	TOTAL AMOUNT
1.	CASH	$	$	$	$
2.	ACCOUNTS RECEIVABLE				
3.	INVENTORY:				
4.	*PURCHASED MATERIAL*				
5.	*MANUFACTURED PARTS*				
6.	*WORK IN PROCESS*				
7.	*FINISHED GOODS*				
8.	TOTAL ( )*				
9.	FIXED ASSETS:				
10.	*LAND AND BUILDINGS*				
11.	*MACHINERY & EQUIPMENT*				
12.	*TOOLING*				
13.	TOTAL				
14.	TOTAL INVESTMENT				
15.	PROFIT				
16.	RETURN ON INVESTMENT	%	%	%	%

* *Inventory Turnover*

SUNK COST:

ENGINEERING	$
TOOLING	
LAND AND BUILDINGS	
MACHINERY & EQUIPMENT	
INVENTORY	
ADVERTISING and SALES PROMOTION	
TOTAL	$

EXHIBIT 3

ment responsibility. We use a term which is not too common—sunk costs. These include expenditures which must be made before any recovery can be effected through sales in any significant volume and which must be made before it can be determined that the product will meet with acceptance. Basically, these are:

1. Market research
2. Engineering
3. Tooling
4. Land, buildings, and machinery
5. Initial inventory
6. Advertising and sales promotion

A new product check list accompanies the sales project from its inception. This serves as a reminder to the estimators of the points to be covered and also indicates the thoroughness of the estimate. It includes the following information:

NEW PRODUCT CHECK LIST

Product .....

Check Condition That Applies

General

( ) Product completely designed, all drawings available

( ) Product partially designed, drawings and sketches available

( ) Design in first stages, no drawings available

( ) Similar to another product in our line

( ) Used other than our drawings. Complete specifications not available

Projected Profit

Number of units

( ) Rough guess

( ) Market survey

( ) Our share of estimated market

( ) Other

Sales

Average selling price

( ) Rough guess

( ) Based on competitive price of similar device

( ) Based on what customer stated he would pay

( ) Based on build up of our costs including profit

( ) Other

Cost of sales

Material

Costs

( ) Purchased material determined from quotations in purchasing

( ) Estimated purchased material price

( ) Based on standard costs

( ) Compared with another product

Quantities

( ) Determined from parts list plus ——% for loss

( ) Estimated from another product

( ) Estimated as percentage of total cost

( ) Other

Direct labor

( ) Detail by operation
( ) Estimated each component
( ) Comparison with another product
( ) Estimated as a percentage of total cost
( ) Other

Factory burden

( ) Used normal rate for department
( ) Used normal rate for division
( ) Used rate of ———%
( ) Estimated as a percentage of total costs
( ) Other

Unusual factory expense estimates

( ) None $———
( ) Special inspection $———
( ) Other $———
Total included in factory expense $———

Engineering expense

( ) Used normal rate of ———%
( ) Normal rate is ———%. Used ———%
( ) Determined from estimate of engineering

Service Engineering

Branch

( ) Used normal rate of engineering
( ) Estimated by manpower count
( ) Used another company's experience
( ) Other

Advertising and sales promotion

( ) Used (normal) (projected) rate of ———
( ) Used another company's experience
( ) Other
( ) Determined from estimate of advertising

Home office selling expense

( ) Used (normal) (projected) rate of ———
( ) Used another company's experience
( ) Other

Administrative expense

( ) Used (normal) (projected) rate of ———
( ) Used another company's experience
( ) Other

Projected Investment

( ) Estimated at the total of ½ month's costs and expenses
( ) Other

Accounts receivable

( ) Used average collection period of ——— days
( ) Used collection period of ———days
( ) Other

Inventory

( ) Estimated in total only using an inventory turn of ——— times a year.
( ) Each inventory classification estimated by considering ———weeks' supply on hand
( ) Other

Fixed assets

Land and buildings

( ) Plan to use existing facilities located at ———

( ) Plan to improve existing facilities located at ———

( ) Plans not complete, but costs estimated at ——

( ) Rough building plans available

( ) Detailed building plans available

( ) Comments

( ) Plan to rent facilities

( ) Location not determined.

( ) Location contemplated at ———

( ) Rental estimated at $—— year

( ) Comments

( ) Plan to purchase land and build at ———

( ) Plans not complete, but land cost estimated at $ ——— building cost at $ ———

( ) Rough building plans available

( ) Detailed building plans available

( ) Comments

Machinery and equipment

( ) None required

( ) Detailed lists available

( ) No lists available

( ) Other

Tooling

( ) None required

( ) Detailed lists available

( ) Other

The appraisal tactic as a whole enables the following to be accomplished:

1. Profitability — increases the chance that all projects released will make a profit.
2. Establishes project ratings. It is better to concentrate on a few projects, and get them launched, than work on many and launch none.
3. Establishes realistic schedules —low profit projects are kept out of the engineering department, which means that there are fewer projects to compete for design, drafting and model shop time.

Moving Into Production and Sales

If the project is approved, as was the plug-in limit switch, authorization is given to release the investment of engineering talent and money. Throughout the design stages of the product, actual engineering expenditures are compared to estimates and, whenever it appears that the estimates will be exceeded, re-estimates are made and processed for authorization in order to keep the cost picture current. Once the design is completed by the engineering staff, a second cost estimate, involving much greater detail, is processed. This serves as a check on the original target figures. Having cleared the second check point, the tooling investment is released and the manufacturing engineering unit establishes the fabricating and assembly procedures. The pricing group sets the sell-

ing price from cost data and from information about competitive devices. The advertising department, in cooperation with the market manager, prepares complete introductory materials. The engineering bulletin is written, trade paper and direct mail ads are prepared, and sample switches for all branch sales offices are requisitioned from the initial production run.

The introductory phase is continued by conducting sales meetings in each area to thoroughly acquaint the field engineers with the new product—in the case cited the new plug-in switch. All phases of the program were designed to strengthen the total marketing effort. Field men responsible for servicing distributors were briefed on holding sales meetings with those distributor salesmen who might make the regular plant use calls. Stock orders were solicited from the distributors. First the distributor had to be convinced that this was a worthwhile addition to the line. What better method exists than to make several plant use calls with the regular distributor salesman? A demonstration of the plug-in switch produced orders for anywhere from one to six dozen switches for test purposes. Concurrent with the push through distributors, the salesmen were demonstrating the switch to their prospects. Total volume of sales for the first three months exceeded our predictions by 50 percent. Not a bad sales record, but the forecast should have been better! Conservatism can be a curse. If you had not been over-conservative, how many so-called marginal products might have been introduced at a profit? Many are not cleared for production because of an unfavorable profit ratio, based upon sales estimates that probably are conservative.

Found, Screened, Appraised, Produced — and Sold

In summary, management is constantly on the alert for new products or improvements for those already in the catalog. Information is used which originates in prospective users' engineering and development departments, in the field organization, and in the research and engineering departments. It is possible to purchase or merge with other companies to expand into new products or to fill in the blank spots in an existing product line. Industrial consultants are most helpful in their special field. Once the new item is found, it must be screened against a product policy, with major emphasis on using the strengths of an organization. The appraisal mechanism must be an important part of the total "go —no go" decision.

The job of forecasting the profit potential and the return on investment of any new or modified product is one of the most difficult facing management today. The 80-percent rate of failure for new products needs to be reduced.

The Policy and Procedure Manual— An Effective Guide to Action

by FRANK F. TETZ

THE MAJOR ACTIVITIES of management—planning, organizing, integrating, and measuring—can be only as effective as the communication which must occur throughout each activity. Practically every transaction which takes place in an organization during each working day occurs within the framework of some broad management policy and more specific system or procedure, but these policies and procedures are only effective to the extent that they are imparted through adequate communication to the organization's personnel.

Oral communication may be adequate for small groups, but the basic medium used for informing most personnel of policies and procedures is the written instruction. To facilitate reference, these instructions are usually grouped together in a company manual or in several manuals. The contents of the overall policy manual must be used by every facet of management, including the accounting function, and also by nonmanagement operating personnel. It is extremely important that the manual provide useful information in a usable and readily available form. The effective manual is one which quickly provides a guide for decision-making and action in specified situations, without further delay or undue reference.

In its principal role as a medium of communication, the company manual is the means by which management establishes or clarifies policies and fixes or assigns responsibility for carrying them out in all areas of an organization's operations (Exhibit 1). Within this responsibility, the manual prescribes the delegation and/or limits of authority for decision-making, while at the same time it minimizes the need for repetitive decisions. By reducing the policies to writing, the manual provides the basis for a more uniform policy interpretation and preserves management policies despite changes in personnel, thus providing for a measure of continuity in management philosophy. It also provides a central reference point for the review and evaluation of policy and pro-

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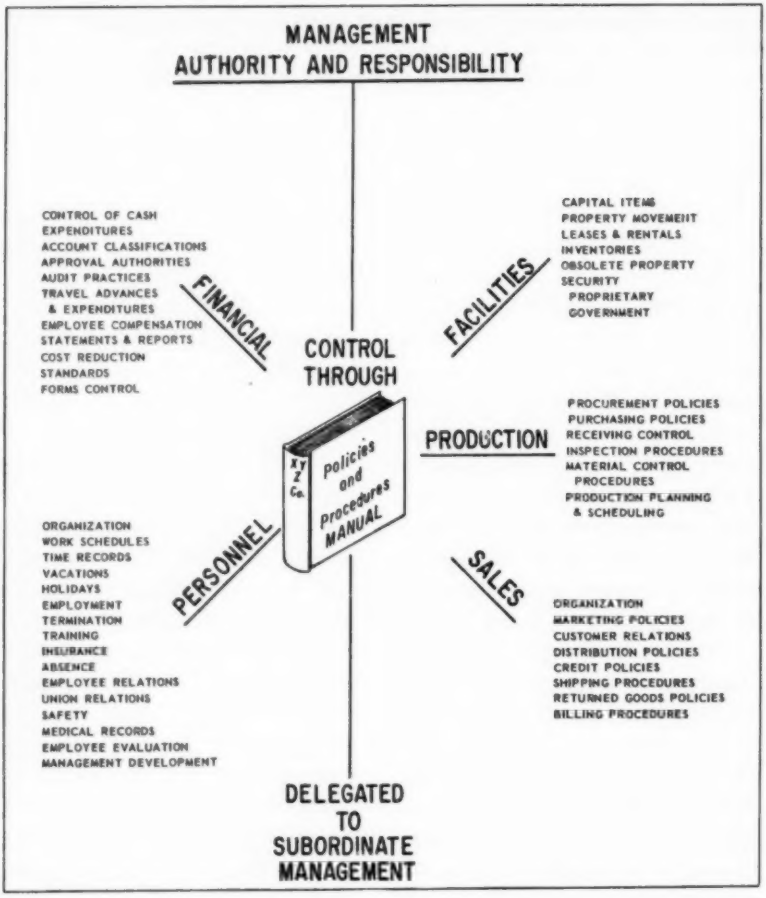


EXHIBIT 1

cedure techniques. The manual, in promoting understanding of company policy, procedures and individual responsibility, is a valuable aid to better employee relations. Other benefits of the company manual include:

1. Use as a training guide to quickly orient personnel.
2. Help in systems and procedures analysis, especially to aid in work simplification and so increase efficiency.
3. Assistance in dictating proper audit control of cash, materials, and labor.

Establishing a Manual

Top management support is of utmost importance in establishing an effective company manual. This is probably more true of a policy and procedure manual than of any other administrative activity, since it is top management which must delineate the policies to be stated in the manual, and whose support will determine to what extent the manual is effectively utilized. A second important requisite is the provision for qualified personnel to develop the manual. Such individuals should have substantial experience, preferably both line and staff, in business management—especially in the accounting field—and must be able to analyze a situation carefully, assemble their thoughts in a logical sequence, and set down in writing the results of the analysis in a clear and forthright manner. In addition, they must be able to deal with all levels of supervision in the development of the manual. Finally, management must stand behind the written policies and procedures which it authorizes. Only in this way can many of the advantages of having written instructions be realized.

Establishing and maintaining the company manual is usually the responsibility of a systems and procedures group. Theoretically, this group should be a staff function reporting directly to the chief executive of the organization, in order to divorce it from functional and line responsibility and areas. It is common, however, to find it reporting to the vice-president, administration; director, management engineering; or to the controller. The benefits of proximity to the financial organization are obvious, since eventually each policy, procedure, and transaction involves accounting (measurement). This is further reason for development of the manual by an accounting-oriented individual.

Little effort is made in this discussion to distinguish between "policies," "procedures," "systems," and "methods." Although a policy usually deals with a broad area or fundamental issue and a procedure typically covers the way in which a policy is carried out, what is policy and what is procedure depends largely on the position from which an operation is viewed. For example, top management may view a tuition loan and refund plan as a procedure within the board policy of training qualified personnel, whereas lower echelons will regard the plan, itself, as a policy within which they must operate. In like manner, a system usually involves several procedures and a method is concerned only with a single operation. But the indefinite and arbitrary distinction between the terms remains because of their integration in application.

Separation between policy and procedure or system and method involves a great deal of hair-splitting each

time an item is to be prepared for release. It is difficult to set up a general standard for determining the distinction, although this must be done in cases in which a manual for policy is separated from an operations manual, a major reason most companies now combine policy and procedure. For purposes of this discussion, a "right" or "standard" definition of these terms, other than as generally outlined above, will not be meaningful and, therefore, will not be attempted.

Several factors should be carefully considered in determining how an organization will communicate its policies and procedures. It must be realized that effective management cannot be based only on adequate written instructions. These are only one of the management tools and must be regarded as such. Indiscriminate publication and reliance on "managing by systems and procedures" may result in indecisive managers, burdensome red tape, excessive paperwork and inadequate training of management personnel. Policies and procedures should not be allowed to usurp the initiative and ability of the manager. Manuals are useful in communicating the basic "what to do" and "how to do it," but do not eliminate the need for management techniques and skill. They should aid, not deter, the accomplishment of the job in the simplest manner possible.

There are three basic types of manuals—management, including policy and organization, functional or administrative such as personnel, purchasing, or accounting, and operational, such as a secretarial handbook or safety manual. Each of these basic types may be combined to form a manual which includes policies, functional and operational procedures, and even organization. The policy manual then becomes the policy and procedure manual, often used today to provide one basic reference source in an organization and to obviate the necessity of searching in several places for various types of information. Once the proper perspective for the purpose and place of the policy and procedure manual is determined, the type of manual depends largely upon such characteristics of the organization as its size, degree of centralization, types of activities, and personnel. For example, a large, centralized organization with plants widely distributed may require a breakdown of policies and procedures into several manuals by function, such as a personnel policy manual, purchasing manual, accounting manual, and sales manual. Or the large, decentralized organization may require only one policy manual at the corporate-wide level, and may allow each division or plant to develop its own policies and procedures, within the framework of the broad company policy. Then, too, the types of written instructions required for a scientific research organization, with its particular kind of personnel,

environment, and goals, may be far different from those required for the factory environment and personnel.

Generally speaking, the most important points to remember in writing instructions and gathering them together in one or several manuals are:

1. Tailor the information to the type of organization and personnel, for the proposed distribution.
2. Facilitate reference ease by limiting the number of manuals.
3. Do not "over-procedurize" or attempt to manage solely by procedures.

Preparation and Maintenance of the Manual

Organization—Selection of the way in which to organize the contents of the manual depends on the character of the enterprise, i.e., its size, organization, complexity and method of controlling operations. In organizing, the principal objective should be to provide the instructions in the most readily available form requiring as little searching as possible, since reference must often be made while on the telephone, in conference, etc. Most authorities in the systems and procedures field maintain that policies and procedures should be indexed by use of a systematic numbering system. That is, blocks of numbers are assigned to all principal categories and subcategories, and each policy or procedure is numbered in accordance with this breakdown. For example, the assignment might be:

000-099 General administrative
100-199 Financial
200-299 Personnel
300-399 Marketing
400-499 Engineering
500-599 Facilities
600-699 Security
700-799 Safety

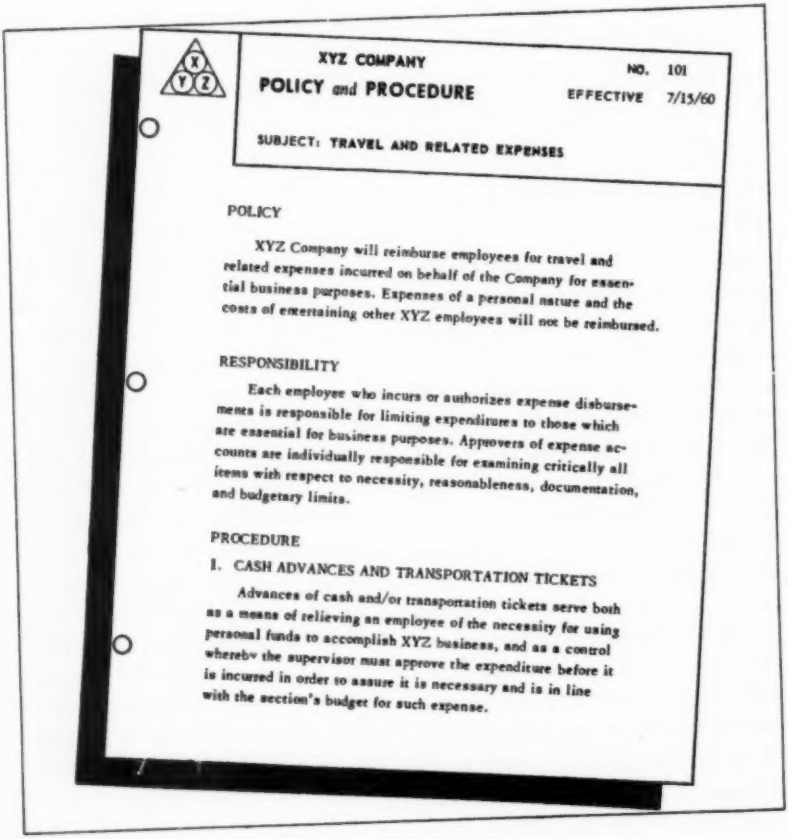
As the need arises, the major categories may be subdivided in the following manner:

100 Financial
- 109 Employee compensation
  - 109-1 Attendance records
  - 109-2 Night shift premium
  - 109-3 Overtime
  - 109-4 Meal allowance
- 110 Travel and related expenses—General policy
  - 110-1 Cash and ticket advances
  - 110-2 Use of credit cards
  - 110-3 Use of personal automobile
  - 110-4 Charter of aircraft service
  - 110-5 Reporting and approval of expenses
- 111 Capital expenditures

The indexing system can be very simple, or it can be rather complex,

with prefixes, 5 or 6-digit code numbers and other mystifying symbols. Emphasis should be placed on simplicity, for a complicated classification system will often merely perplex the individual attempting to refer to a specific instruction and may break down as the manual grows in size.

Format—An impressive standardized format aids in giving the instructions an official image—which may help to sell their acceptance and use. One such format appears in Exhibit 2. The attractiveness of the format is a hidden persuader which can be unobtrusively employed to provide a favorable attitude on the part of the person referring to the manual. The procedure number, effective date, and sub-



XYZ COMPANY

POLICY *and* **PROCEDURE**

NO. 101

EFFECTIVE 7/15/60

SUBJECT: TRAVEL AND RELATED EXPENSES

POLICY

XYZ Company will reimburse employees for travel and related expenses incurred on behalf of the Company for essential business purposes. Expenses of a personal nature and the costs of entertaining other XYZ employees will not be reimbursed.

RESPONSIBILITY

Each employee who incurs or authorizes expense disbursements is responsible for limiting expenditures to those which are essential for business purposes. Approvers of expense accounts are individually responsible for examining critically all items with respect to necessity, reasonableness, documentation, and budgetary limits.

PROCEDURE

1. CASH ADVANCES AND TRANSPORTATION TICKETS

Advances of cash and/or transportation tickets serve both as a means of relieving an employee of the necessity for using personal funds to accomplish XYZ business, and as a control whereby the supervisor must approve the expenditure before it is incurred in order to assure it is necessary and is in line with the section's budget for such expense.

EXHIBIT 2

ject title should be prominently displayed. The identity of the writer and approver, and other information such as issue superseded (if this is a revision) may appear on the first page, or may be more inconspicuously noted at the end of the procedure in order to keep the first page as simple and readable as possible.

Contents—Procedures people must often be reminded that the manual is not an end in itself but merely a ve-

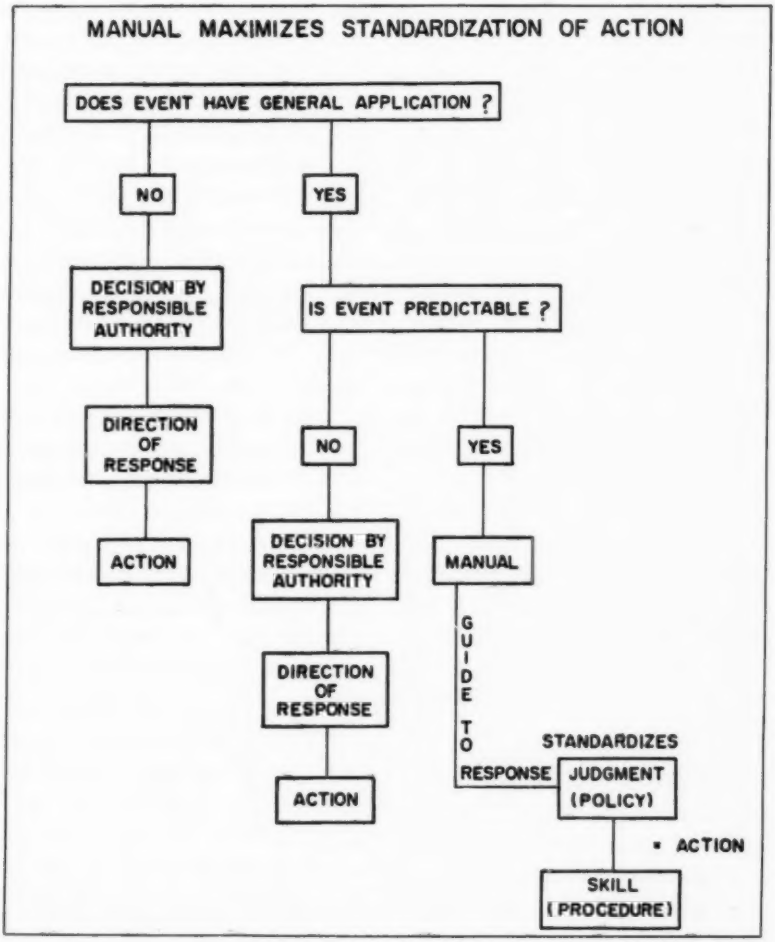


EXHIBIT 3

hicle to aid in attaining effective management operation, just as a road map prescribes the proper route to a given destination if it is carefully read and followed. It is a plan of operations, similar in function to that of a budget. The contents of the manual must be carefully chosen to include only those subjects upon which repeated action will be taken.

Action to be taken when predictable events occur is standardized in the manual to maximize two levels of response: judgment (policy) and technical skill (procedure). Exhibit 3 depicts action which cannot, and which can, be facilitated in this way. As unpredictable events occur, the responsible authority directs the appropriate action through the decision-making process. If an unpredictable event occurs frequently enough and has rather general application, its treatment is eventually included in the manual. Thus, there are two basic factors to be considered in determining what goes into the manual: predictability and applicability. Both factors must be satisfied prior to including an instruction concerning a specific subject in the manual.

Use of policy and procedure instructions dictate that they should contain only information pertinent to the subject being presented. The instruction is an instrument for use at a particular point of time. The more material that it contains which is unrelated to the specific need at that time, the more ineffective is the procedure. More specifically, there is generally no need to include in policies and procedures a statement of purpose, for the title usually infers the purpose. Likewise, an introduction to the individual instruction is usually superfluous, although it might be useful for the manual in its entirety. Cross-references can be annoying and confusing if carried to extreme. There may be certain items that must be duplicated in more than one instruction for easy reference. For example, throughout the manual policies regarding part-time employees may be stated under instructions such as "vacations," "holidays," "insurance," etc., but it may be advantageous to also have one instruction on part-time employees. However, as a rule, the policy or procedure should be independent. Titles and paragraphing should be used extensively, since these facilitate easy reference.

Style—The test of a good policy or procedure is demonstrated in the ability of a reader to transfer the words from the paper on which they are written into action. The difficult task of thinking through the subject and structuring the policy, procedure or system in a well organized, logical, action-stimulating manner is not done by the reader of the manual but by the writer. Much of the success of attaining the goal of action depends on the presentation.

The important point in writing in-

structions for the manual is to establish contact with the individuals who will use it. This does not require "talking down" to the individuals, but it suggests that the material should be oriented to the supervisors, clerks, etc., who will generally be referring to the manual for guidance. This is particularly important, since the person responsible for the preparation of policy and procedure instructions may himself grow more and more management-oriented—a situation which may show in his style of writing. He must work the policy or procedure out with all levels of management and important operating personnel directly involved, to develop a common language acceptable to the users.

Many of the details relating to an instruction or directive are self-evident and need no written statement. The procedures writer should avoid talking the subject to death. He should note which parts of a procedure are often confused, emphasize these, and play down the rest. For example, in explaining a form, directions are unnecessary for completing items such as name and address.

To avoid over-communication, information should be provided, not just facts. The reporting of information was aptly described by Kipling:

"I keep six honest serving-men
(They taught me all I knew);
Their names are What and Why
and When
And How and Where and Who."

Although information usually includes "who" does "what," "when," "how," and "why," only the "what" and "how" have to be emphasized in the manual, for these initiate action. The "who" is usually the reader of the manual, the "when" is usually the time of reference, and the "why," if it arises, is to be answered by the supervisor.

Getting specific action can best be initiated by simple declarative or imperative sentences, presented in a matter-of-fact way. The voice or verb tense used in writing should be especially carefully chosen, for it sets the tone of the manual and is thus indicative of the atmosphere in the organization. The cookbook style (imperative) is preferred by many organizations for its forthright appearance and conciseness, e.g., "mix butter with eggs," but it may be considered ineffective or offensive in some organizations. Future tense (will) gives a commanding tone to the manual. The use of "must" hardens this tone, while the use of the conditional auxiliary verb, "should," softens the tone. The present tense gives the impression that the action is performed in a certain manner without deviation allowed, yet it is not really authoritarian.

A one-page chart or diagram is often more effective in initiating action than several pages of wordy detail. In fact, flow charts and diagrams are indispensable to the procedure

part of a manual. Some operational manuals are presented primarily by means of charting. Furthermore, charts may provide additional eye appeal which can be a hidden persuader in "selling" the procedure.

Careful use of the organization's resources should not only be the goal of the context of most policies and procedures; it should also be incorporated into the structure of the procedure itself. Only necessary words and sentences should be used. It costs far more for all users to edit the manual than for the writer.

The manual should adhere to grammar rules where possible, but the true test of worth is whether a phrase or sentence gets the job done.

Approval—Prior to issuance of a policy and procedure to be included in the manual, it is desirable to have the agreement of all key personnel concerned with operating within its scope, usually obtained by circulating several copies of a draft of the proposed instruction. This may be time-consuming, for often an instruction will affect many functional operations. It is well worth the effort, however, for agreement prior to issuance saves later retraction, early revision, and possible refusal to accept the instruction unless required to do so by an authoritarian management. Also, useful suggestions for systems improvements are often a by-product of reviews by operating personnel. This is especially true in the event it is necessary to hold a meeting of several of the persons to iron out differences of opinion.

Final approval of the policies and procedures should be the designated responsibility of one executive in the organization. This precludes encountering road-blocks from inability to obtain agreement among operating personnel on certain aspects of the instruction, and allows the procedures personnel necessary discretion in adopting or rejecting proposed inclusions or changes. The final approver may be the top operating executive of the organization, but more often he has delegated the authority to the manager who has responsibility for the manual—the administrative director, controller, budget or systems manager, etc., dependent on the organization. In any case, the chief executive will usually want to be apprised of all policy statements to be included in the manual.

Revisions—The very nature of the function which the manual is intended to perform in administration dictates that it must be continually revised, for it is obvious that the value of the manual depends upon the current validity of the information which it contains. Employees lose confidence in a manual that is not up-to-date. The organization, the economic environment, and many other internal and external factors—including policy itself—are in a perpetual state of

flux. Procedure, of course, is constantly changing, for it can always be improved. No sooner has a clerical procedure for accounts receivable been instituted, for example, than it is being gradually modified by the accounts receivable clerks. Such modification should be encouraged within certain limits set forth by requirements prescribed by standard instructions in the manual, proper accounting practice, and by supervision. Therefore, the manual must not only be kept up-to-date with these changes, but its usage should be instrumental in anticipating and facilitating them. Only in this way will it be most effective.

This matter affects the way in which manuals are issued. Bound manuals should be limited to rather general or broad policy statements only, to prevent their being out of date almost before issuance. The use of loose-leaf pages in a ring binder is of particular value when revisions are required. The most expedient means of making timely revisions is to re-issue the particular page when data is to be revised on it. It is helpful if some method is used to indicate which pages are revisions, for example, a revision date notation, use of special or colored paper, or some other eye-catching device.

Other methods of revision which do not appear as effective can be used for either bound or loose-leaf manuals, including the issuance of supplements and paste-overs, or instructions to note a change in the margin of a particular page. These may sometimes become too complex for immediate disposition and, with the introduction of the human error factor, they may never be applied.

All revisions, of course, must be approved in accordance with the extent to which they change the original policy and procedure; preferably by the executive who approved the policy.

Distribution and Use

In a recent survey[1] on office manuals by the American Management Association, the most prominent negative comment on the question of whether the manuals achieve their goal was not related to content or form but to their effectiveness in disseminating information to subordinates. In many instances, it was reported, manual information was not passed on by supervision. This was not, to be sure, so much an indication of the worth of the procedures, as of the competence of the supervision. However, since communication is the prime function of the company manual, if the information in the manual does not reach the personnel who have use for it, the program has not achieved its goal.

It is not enough to state that the manual should have as broad a distribution as possible, for there are several other factors to consider than merely quantity. The most important factor,

[1] "Preparing the Office Manual," M. Graham Kellogg, Research Study Number 36, American Management Association, Inc., New York, N .Y.

of course, is consideration of who uses the manual. This is often determined by the type of manual. For example, policy manuals are usually directed for use by top management personnel, while procedure manuals apply primarily to first-line supervisors and operating personnel. Manuals which combine both policy and procedure may apply to all managers and supervisors.

In a small company it may be possible to issue a manual to every supervisor, and even to all employees in some cases, but this often is not practicable in the large company. Rather, a better approach is to provide access to the manual by ensuring that there is a manual available in each area. Supervisors and operating personnel directly affected by specific policies and procedures may request copies of these particular instructions, without requiring the entire manual.

It is obvious that, regardless of the breadth of the distribution, the effectiveness of the manual depends upon dissemination of its contents by supervision. If the manual is to accomplish its purpose, it must be in frequent use and, therefore, must be readily available to each person requiring it. Subjects carefully chosen for applicability, the manual well organized for each reference, policies and procedures clearly and concisely written—all of these will be valueless if the manual does not reach employees who need the information in their daily activities.

Evaluating the Manual

Is the policy and procedure manual worth the time, effort and money expended on it? The elements of this question are in proper order. Frequent review should be made of exactly what function the manual is performing and to what degree it is successful. This success may be measured in both tangible dollar-and-cents savings relating to operations, forms, and procedures simplified, and in such intangible benefits as decision-making time reduced and improved employee morale through uniformity in application to policies and adherence to procedures.

The best evaluation of a manual is by the people who use it, but even adequate communication is of no consequence unless management authority stands behind each policy and procedure in the manual. Deliberate deviations from the written policy, even where there are what appear to be extenuating circumstances, serve merely to confuse operating personnel and may establish dangerous and costly precedent. The necessity for frequent deviation is an indication of policy which is either inadequate or too rigid.

In the final analysis, the manual can be an effective guide to action, from top management to the operating level. The manual can perform the indispensable task of providing adequate management communication. The end result will be greater efficiency and better performance.

Significant Indicators for a One-Page Plant Report

by RICHARD L. WOODRUFF

OUR COMPANY is one of the world's foremost industrial furnace designers and manufacturers. Because of the special nature of our orders, we operate a job order plant, each order independently accounted for. Nearly every type of industry has a need for the equipment that we furnish. Our furnaces can vary from a soaking pit for steel mills the size of a city block to a small lead-melting furnace for a country newspaper. Other orders involve equipment for processing sheet and strip steel, all types of parts for automotive equipment and for industries requiring heat treating, brass and aluminum processing, glass annealing and decorating, industrial air conditioning and gas generating equipment. Orders small enough for shipping as a unit or which can be assembled and then dismantled into component parts requiring little field labor, are handled in the Toledo plant. Because of the size factor, the greater number of the orders has only the steel fabricated and machine work done in Toledo. They are then shipped to the job site for erection.

Reports in Use

The complexity of our products requires plant controls so that management will be informed as to the performance of the manufacturing facilities. It has been and still is the custom to furnish the plant manager and all other plant supervision under his control with individual reports covering all phases of our operations. These individual reports include variable budget charts, labor reports on performance during the month, reports on building and service expense, department budgets, inventory turnover, reports on tonnage cut and personnel reports on absenteeism and accidents.

The Indicator Report

The use of so many control reports created consciousness of a definite additional need for a report that would consolidate all of this detail and would show at a single glance the performance of the plant operations. A number of meetings were held to discuss the type of report that could be made, using the information that was on hand. It was concluded that a report of selected items, indicating by "index weights" the importance of each, would serve the needs of management better than anything else. In such a report each indicator on the report is accorded a fixed number of index points to draw attention to its proportionate significance. As preparation it was necessary that all indicators to be included in the report be accumulated and catalogued and that index weightings be assigned.

RICHARD L. WOODRUFF, Toledo Chapter, 1955, is Chief Cost Accountant, Surface Combustion Division, Midland-Ross Corp., Toledo, Ohio. He has been with his company since 1946.

EXHIBIT I

*Asterisk Denotes Unfavorable

Toledo Plant Operating Statistics

_____ Month Ending ___

Item	Expense Controls	Unit of Measurement	Act. This Mo.	Year to Date - Mo. Act. This Yr.	Var. Budget	Act. Last Yr.	Index Wgt.	Budget % Chg.	Last Year % Chg.	Original Budget
1	Admin. Expense	Cost/D.L. Hr.					3			
2	Production Dept.	Cost/D.L. Hr.					20			
3	Other Expense	Cost/D.L. Hr.					4			
4	Building Expense	Cost 100 Sq. Ft.					1			
5	Service Expense	Cost 100 Sq. Ft.					2			
6	Brick Dept.-Std. Fce.	% of Std. Hrs.					7			
7	Fab. Dept.-Std. Fce.	% of Std. Hrs.					8			
8	Fab. Casing & Drive Stl.	% of Std. Hrs.					25			
9	Mach. Dept. Stock Orders	% of Std. Hrs.					5			
10	Fab. Dept. Prefab.	Hrs./Ton					5			
11	Total Exp. Controls									
12										
13	Operation Controls									
14	D. L. Hrs. to Total Hrs.	%					5			
15	Salary Emp. to Hr. Emp.	%					2			
16	Absenteeism-Unexcused	%					1			
17	Lost Time Acc.Frequency per 100 M-Hrs.						.5			
18	Lost Time Acc. Severity-per M Man Days						.5			
19	Orders Shipped on Time	%					5			
20	Inventory Turnover	Usage/Inv. Value					5			
21	Fab. Dept. Hr. Rate	Average					1			
22	Total Opr. Controls									
23										
24	Total Plant Control Index									
25										
26	Unweighted Factors									
27	Tons of Steel Cut									
28	Total Hours Worked-M									
29	Direct Labor Hrs.-M									
30	Total Hourly Emp.									
31	Total Salary Emp.									
32	Fixed Expense/D.L. Hr.									
33	% OT Hrs. to Base Hrs.									
34	Total Factory Exp./D.L.Hr.									

A total index of one hundred points was agreed to and discussions were held between executive management and plant management to determine the breakdown of the points among the elements that were to be included on the report. As could be expected, individual disagreements arose to some of the original selected weightings, but, through discussion, these differences were solved and distribution of points agreed upon. Agreement on the selection of index weightings is a definite requirement if the report is to function to the advantage of all concerned.

It was established that the form, which is exemplified by Exhibit 1, should list the indicators and have columns to show, besides the weighting index, actual figures for the month, actual year-to-date figures, variable budget figures and actual last-year-to-date figures. With these sets of figures, which were available, we could then compute percent of change in the budget comparison column and the last-year comparison column.

The Indicators Themselves

Ten indicators make up the expense control section, eight the operation control section and eight close the report, designated as unweighted controls. The unit in which each indicator is expressed in the report is shown in the column following identification of the indicator, making it clear to the reader exactly how it is measured. The importance of each indicator can be clearly seen by looking down the index-weighting column. However, computations are not made from these weights. They simply inform the reader of the assigned relative importance of the indicators. Those having high weightings are elements that require close attention, although one must not overlook the lower weighted elements or they will get out of hand and throw the total operating figure out of line.

A brief description is given below of what is included in each item on Exhibit 1:

Item	*Description*
1. Administration department	All office departments labor and expense.
2. Production department	All plant indirect labor and expense.
3. Other expense	Miscellaneous charges such as power, alterations, labor overtime, product tooling.
4. Building expense	Building charges and all maintenance.
5. Service expense	Expense in service to all buildings (janitor, watchmen, cleaning supplies, electric, gas, water, heating).
6. Brick Dept.—Standard force	Mason labor performance.
7. Fabricating Dept.—Standard force	Labor performance.
8. Fabricating casing and drive steel	Labor performance of custom force.

Item	*Description*
9. Machining Dept.—Stock orders	Machining labor performance of stock parts.
10. Fabricating Dept. — Prefab group	Labor performance on readying material for fitting and welding.
14. Direct labor hours to total hours	Ratio of plant direct labor to total plant hours.
15. Salary employees to hourly employees	Ratio of total plant salary employees to total plant hourly employees.
16. Absenteeism—unexcused	All plant hourly employees absent.
17. Lost time accidents — Frequency	Ratio of the number of accidents that occur per 100 M hours.
18. Lost time accidents—Severity	Ratio of the number of days lost to M man days.
19. Orders shipped on time	Ratio of orders shipped on time to total shipped.
20. Inventory turnover	Ratio stock material usage to inventory.
21. Fabricating Dept.—hourly rate	Average actual rate.
(Unweighted Factors)	
27. Tons of steel cut	Actual tonnage cut by shears.
28. Total hours worked	Total plant hours.
29. Direct labor hours	Total plant direct labor.
30. Total hourly employees	Total plant hourly employees.
31. Total salary employees	Total plant salary employees.
32. Fixed expense	Bldg. charges—depreciation, insurance and taxes.
33. Overtime hours to straight time hours	Ratio of overtime to straight time.
34. Total factory expense	Total administrative and production and service department expenses, and fixed expense.

Comparable Indicators in All Companies

All of the items on this form or items of like significance to the operating picture can be found in any organization. If there is any problem of choice or development of information, it can be resolved through investigation. Once elements indicative of performance have been selected and index weightings agreed to, presentation is an easy function. We believe that this report is simplicity in its true form. It is used both by executive management and plant management as a gauge of the performance of the manufacturing portion of the organization. Now that we have this information, we would not be without it.

Inventory Control of Engineering Work-In-Process —A Case Study

by H. EUGENE MENZEL

TO MOST people inventory control carries with it the connotation of control of finished goods, parts or raw materials and work-in-process inventories of manufacturing operations. There, however, exists another area of inventory in our company, and others like ours, that probably is less directly thought of in connection with inventory control. This area is engineering work-in-process. It is hoped that the following description of a fairly simple technique used by our company will be of value to other companies.

By engineering work-in-process we mean those dollars which have been accumulated against specified engineering tasks, the accomplishment of which will result in future sales. Our objective is to minimize the cost of capital. This, of course, is the basic objective of any inventory control program. Reports to management on inventory control should be slanted toward this objective.

In the manufacturing work-in-process area certain standard relationships can be obtained; specific amount of input should result in a specific amount of output. Also, total levels are indicative of trends; a build up of dollars could be caused either by increased volume levels or improper management of factors affecting inventory. This is not the case in the engineering work-in-process area. Engineering jobs usually involve a substantial period of time from first cost input to final delivery, with considerable variety between jobs and a large portion of the cost generated by labor and overhead. Hence, it is not particularly adaptable to averages. For this reason, perfect inventory control could exist, yet work-in-process dollar totals could continue to spiral upward, without an increase in volume of work done. At some point these work-in-process totals will then suddenly stop accumulating and take downward trend.

As an example, let us assume that total monthly input capability is represented by the figure 1000 and that two new major and several lesser jobs are started in the same month, with additional jobs added throughout the period, and final accomplishment of the two major jobs in Months 5 and 6. We may have work-in-process levels something like those below:

	Month 1	*Month 2*	*Month 3*	*Month 4*	*Month 5*	*Month 6*
Input						
Jobs 1 and 2	600	700	700	800	500	200
Other	400	300	300	200	500	800

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	Month 1	*Month 2*	*Month 3*	*Month 4*	*Month 5*	*Month 6*
Output (Delivery)						
Job 1	—	—	—	—	1000	
Job 2	—	—	—	—	—	2500
Other	—	—	400	—	300	200
Work-in-process	1000	2000	2600	3600	3300	1600

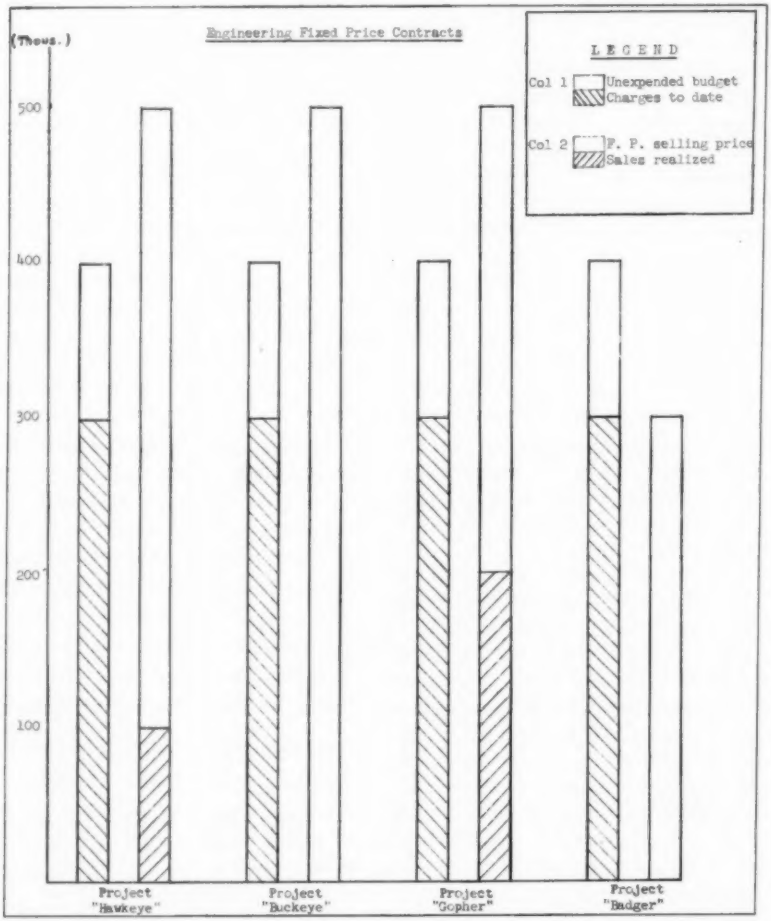

EXHIBIT I

Unfortunately the arithmetic of the situation, even though everything is progressing as it should, would leave management possibly a bit more than jumpy about the increasing spiral from Month 1 to Month 5. An evasive answer by the accountant that engineering work-in-process is a peculiar animal brings small consolation. We must be prepared, at the very least, to provide working tools that will keep it at the lowest possible levels.

This, then, brings us to the report that is generated within our accounting department, not so much to explain the total work-in-process level as to provide a working tool to our engineering management for priority action. We have found in our business that, by continuing active control of only relatively few jobs, 70 to 80 percent of the work-in-process dollars will be accounted for at any given point in time. Although continuing analysis of all jobs is regularly carried on, our reporting is restricted to those jobs which cover this percentage range of the total amount involved, as illustrated by the report below and supplementary graph on Exhibit 1:

To: Director of Engineering
From: Engineering Accounting Department
Subject: Engineering work-in-process as of 1/31

A comparison of January work-in-process levels with those of the previous two months is as follows:

	Engineering work-in-process ($ x 1,000)		
	January	December	November
Beginning balance	1,350	1,300	1,200
Monthly additions	300	350	300
Monthly relief	(450)	(300)	(200)
Ending balance	1,200	1,350	1,300

Four of our projects account for approximately 75% of our work-in-process inventory. The attached graph* indicates the status of these projects. Comments pertaining to the graph follow:

Project *Buckeye* comprises about 25% of our total inventory. However, no sales will be realized until the project is completed. It appears that $100,000 of additional engineering effort will bring forth $500,000 of sales.

Project *Hawkeye*. The design data report portion of this contract is priced at $100,000. The written report on this aspect of the contract will "trigger" the customer billing. Our budget figures indicate $21,000 of effort remains to be completed.

Project *Badger*. Our graph indicates that $300,000 of sales will be realized upon an expenditure of $100,000. However, our analysis revealed that completion of the environmental test report will generate sales of $200,000. Since only $10,000 of effort remains, this job should be given a priority rating.

Project *Gopher*. Sales of $100,000 were realized in the first week of February and are not yet reflected in the graph.

* See Exhibit 1.

Thus, it is apparent that engineering management will be well advised to place priority action on those jobs which will yield the highest amount of sales for the least amount of immediate dollar expenditures. This, of course, is subject to attainability from a technical standpoint. Also, in our way of doing business, any project may have sub-items which will result in sales. The impact of such items is brought out in the remarks preceding the graphs, as shown above.

This report is obviously not the answer to all problems. However, from the knowledge gained in the pursuit of such analysis, various other analysis can be made such as:

1. Prediction of future work-in-process levels which will have impact on cash-flow requirements.
2. More sophisticated inventory control reports which involve matching of actual month/dollars by job with predicted month/dollar budgets by job. This, however, is a subject in itself, which requires definition of guidemarks of accomplishment, and acceptance by management of the discipline inherent in it.

It would be fair to add that this report is not the result of any ingenious accounting technique but rather the result of hard work, good organization, and the awareness of the accountant of what is going on around him.

It does one very important thing. It effectively serves engineering management and makes the accountant a valuable member of the management. This, I believe, is a goal of accountants and accounting.

Accountant—Spare That Variance!

by ROBERT W. ROSEN*

NORMALLY, a red variance of 18 percent would indicate poor performance and trigger corrective action. This report, however, will try to demonstrate that: (1) some variances are not only necessary but desirable and (2) efforts to redress such variances will increase—not decrease—production costs. Evidence to buttress such strange conclusions will be presented by analyzing a typical, but vastly oversimplified problem in scheduling production.

Essentially, schedules are plans for producing a given quantity of items in the least amount of time and cost. Such endeavors necessarily involve cost comparisons between alternative routings and machine assignments. Where standard cost is available, the logical procedure would be to assign the manufacture of each product to the machine with the lowest standard costs. Yet, rigid adherence to standard costs may often yield a schedule which is not least-cost, as the following example will show:

(1)	(2)	*Total machine hours required*		
Product	*Units*	M. 1	M. 2	M. 3
A	20	85	—	100
B	30	90	87	—
C	18	90	85	180
Available machine hours		90	90	200

According to the above data a company has orders for 20 units of Product A, 30 units of Product B, and 18 units of Product C. The alternative methods of manufacturing each product and the total number of machine hours required by each such alternative machine are shown to the right. Reading from left to right, it can be seen that Machine 1 requires a total of 85 hours to produce 20 units of A, whereas Machine 3 would require 100 hours. Similarly, to manufacture 30 units of B would require a total of 90 hours on Machine 1 as against 87 hours on Machine 2. Dash lines appearing in the table indicate where production cannot take place for technological reasons. Thus, Machine 2 cannot produce Product A, and Product B cannot be processed on Machine 3. Line hours available on each machine are given in the last row: 90 hours are available on Machine 1, 90 hours on Machine 2, and 200 hours on Machine 3.

Using the common-sense rule of assigning each product to the most efficient machine, Product A would be assigned to Machine 1 because it requires only 85 hours, whereas the only other alternative, Machine 3, requires 100 machine hours. Similarly, Product B would be assigned to Machine 2 and Product C would also be assigned to Machine 2. Obviously, this schedule will not work because it overloads Machine 2. Only 90 hours are available on Machine 2, but 172 hours of work have been assigned, consisting of 87 hours to manufacture Product B, and 85 hours to manufacture Product C. This overloading results from the fact that Machine 2 is the most economical, or "standard," as-

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signment for both Products B and C. How can this bottleneck be broken? Neither Product B nor C can be shifted to Machine 1, inasmuch as its available 90 hours are already committed to producing Product A. If for any reason A is shifted, it will no longer be produced in the most efficient or "standard" manner. Product B cannot be assigned to Machine 3 for technological reasons and, hence, there is no choice but to produce it on Machine 2. Consequently, Product C must be shifted to Machine 3, in order to break the bottleneck. The final schedule, therefore, assigns Product A to Machine 1, Product B to Machine 2 and Product C to Machine 3. This program is feasible because no machine is overloaded. Moreover, two of the three products, A and B, will be produced in the least or standard time. Product C, however, will show an unavoidable variance of 95 hours if the common-sense rule of assigning each product to the standard machine is applied. The total hours required for the program then becomes 352 machine hours, consisting of 85 for A, 87 for B, and 180 for C.

Further inspection of the data given reveals that an even more efficient schedule can be constructed. This revised schedule assigns the manufacture of Product A, to Machine 3, Product B to Machine 1 and Product C to Machine 2. Hence, the machine hours required by this program would be 100 for A, 90 for B, and 85 for C, or a combined total of 275 machine hours. The revised schedule, therefore, cuts total machine hours needed by 77, or 24 percent below the original schedule. Moreover, no other schedule can effectuate a further reduction in processing time. Hence, any modifications or deviations from this program will cause combined machine hours, or costs, to increase.

Examining the optimum solution more closely shows that the running time on both Products A and B will be in excess of standard. For example, the variance on Product A is 18 percent, the difference between the standard, or minimum, time of 85 hours and the assigned hours, 100. Yet, any effort to correct this variance can be accomplished only by rejuggling the machine assignments. Since the program is already an optimum, any reshuffling will increase — not decrease — total machine hours required. Accordingly, no effort should be made to get Product A back to "standard."

Several closely related conclusions may be drawn from the sample problem just reviewed. First, the common-sense procedure of loading machines to accord with standard or minimum costs does not always yield an optimum schedule for the system as a whole. Second, the machine loading schedule which optimizes the system as a whole may contain more "nonstandard" assignments than could be arrived at by other methods. Third, lowest cost, or running time, for all products combined can often be achieved only if one or more products are deliberately assigned to less efficient machines. And, fourth, efforts to "correct" these deviations from standard will increase the cost of operation.

The above analysis helps to spotlight one of the weaknesses of traditional variance analysis, namely, its seemingly exclusive preoccupation with optimizing specific products or processes, rather than over-all systems or programs. Such narrow perspectives often obscure potential savings or cost reducing opportunities of the kind which deliberately increase one cost in order to gain even larger savings elsewhere in the same system. It is in this connection that operations research techniques often yield better results than more traditional methods. Operations research techniques are designed to optimize the system as a

whole, with little or no regard for the welfare of any sub-set within that system. In fact, operations research methods typically proceed on the uncommon assumption that system optimization can be achieved only by deliberately disadvantaging one or more parts of the system being investigated. In turn, operations research devices offer a real opportunity to evaluate and improve business decision-making processes.

How Shall We Charge Off Mold Cost in a Style Business?

by EDWARD B. PERRY*

AMORTIZATION OF MOLDS as a normal business practice presents no great problem. The estimated life of the mold is divided into the cost, and the resulting figure is added to the cost per thousand "shots." If there is reason to doubt the salability of the product, a sample mold is made, a market test of the product is completed and results analyzed, and a decision is made based on this information. However, our company, a manufacturer of costume jewelry, has a subsidiary company in which the cost of molds is our biggest problem. The subsidiary does plastic injection molding of plastic stones and beads for the parent company and also for suppliers to the parent company.

Why is the jewelry business different? The answer is style and the alacrity with which a style business must move if it is to survive. We do use the sample cavity to produce samples for our designers and merchandise men, but time precludes any further postponement of this decision to make or not make the mold. These men know that their opinion and judgment will be wrong in many cases. They also know that their batting average will vary significantly from season to season and year to year.

We are accustomed to the style factor in our business and the decisions which must be made swiftly. We are reconciled to the awful knowledge that these decisions, with their resulting commitments, are going to end, in many cases, with an inventory piled on a shelf, a model or sample wasted, a design that no one wishes, and a myriad of other costs that must be recovered from our successful guesses. This philosophy of business is not new with us and we have coped with it over many years.

Why then must the amortization of these molds represent such a problem to us? The answer lies in the relatively large investment per mold. A review of one typical year brings out the following, which dramatically illustrates the problem. Our expenditure in molds per molding machine was 130 percent of the basic cost of the machine; our overhead in the department, exclusive of mold costs, was 131 percent of direct labor; and our mold cost was 234 percent of direct labor. We strive earnestly and with continuous vigor to reduce the 131 percent; however, we face the mold cost with the fatalistic approach that reduction of this would mean loss of the continuous new look and a threat to our position of leadership in the costume jewelry field. Add to all this our conservative concept that a mold is an expense and at no time does it have any capital value.

There is still another complication to our

*Treasurer, Coro Inc., Providence, Rhode Island.

approach to this problem. The products of our injection mold room fall into two categories: stones and fancy beads, which are the highly stylized items, and the so-called staple varieties of stones and beads. The word "staple" is relative as used in our business. It means simply that these sizes and shapes have a certain public acceptance and that the probability of volume for a given season can be calculated with a fair degree of accuracy. It also means that there is some chance of carry-over of salable stock into the next season. The staples are extremely competitive and allowance for mold cost must be kept at a low minimum.

How do we handle this mold cost problem? What we do is to spread estimated cost of molds on a budget basis over a six-month period. We also estimate the percent of production that will be devoted to the fancy and to the staple categories. We assign as much as competition will allow to the staple categories in terms of machine hours and the remainder to the fancy category.

Thus, we have, in effect, given up the idea that our molds can be amortized and have resolved, or attempted to resolve, the problem by trying to treat them as a very special type of cost spread on a budget basis for a given period. This means that we are faced with a disproportionate and fluctuating cost in our operation of molds. The normal accounting procedures of amortization are impractical for us. We know of no other way than to use a budget basis with the hope that our average of good decisions will be high enough to let us live within this budgeted figure.

Is there a better way of handling this problem? Probably there is but we need someone to give us a better measuring stick. Our struggle with this cost is, to say the least, frustrating. We are certainly open to any and all suggestions.

Beyond These Covers

Books

Financial Statement Analysis

John N. Myer, Prentice-Hall, Inc., Englewood Cliffs, New Jersey, Third Edition, 1961, 276 pp., $9.35.

The imparting of thorough familiarity with the structure and potentials of financial statements appears to be the mission of the substantial introductory section of this book. The second section deals with analytical techniques. The tool of obtaining ratios that are truly serviceable for statement comparisons is tackled in the chapter entitled "Standard Ratios," in which "homogenous grouping" of enterprises is a subtopic.

Advanced Accounting

Bedford, Perry and Wyatt, John Wiley & Sons, Inc., 440 Park Ave. South, New York 16, N. Y., 1961, 781 pp., $9.95.

"An organizational approach," marks this text in which the sectional sequence is formation, maintenance, expansion, contraction and liquidation of business organizations. Accounting statement basis, construction and presentation play the most prominent part in the book.

STATEMENT REQUIRED BY THE ACT OF AUGUST 24, 1912, AS AMENDED BY THE ACTS OF MARCH 3, 1933, JULY 2, 1946 and JUNE 11, 1960 (74 STAT. 208) SHOWING THE OWNERSHIP, MANAGEMENT, AND CIRCULATION OF N.A.A. BULLETIN (Formerly N.A.C.A. Bulletin) published monthly at New York, N. Y., for October 1, 1961.

1. The names and addresses of the publisher, editor, managing editor, and business managers are: Publisher, National Association of Accountants, 505 Park Avenue, New York 22, N. Y.; Editor, George F. Wyman, 505 Park Avenue, New York 22, N. Y.; Managing Editor, None; Business Manager, Raymond P. Marple, 505 Park Avenue, New York 22, N. Y.

2. The owner is: If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual member, must be given.) National Association of Accountants (Owner), 505 Park Avenue, New York 22, N. Y.; Donald G. Eder (President), Youngstown Steel Door Co., P.O. Box 1379, Youngstown, Ohio; Rawn Brinkley (Secretary), 505 Park Avenue, New York 22, N. Y.; Merwin P. Cass (Treasurer), Chas F. Rittenhouse & Co., 130 William St., New York 38, N. Y.

3. The known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

4. Paragraphs 2 and 3 include, in cases where the stockholder or security holder appears upon the books of the company as trustee or in any other fiduciary relation, the name of the person or corporation for whom such trustee is acting; also the statements in the two paragraphs show the affiant's full knowledge and belief as to the circumstances and conditions under which stockholders and security holders who do not appear upon the books of the company as trustees, hold stock and securities in a capacity other than that of a bona fide owner.

5. The average number of copies of each issue of this publication sold or distributed, through the mails or otherwise, to paid subscribers during the 12 months preceding the date shown above was: (This information is required by the act of June 11, 1960 to be included in all statements regardless of frequency of issue.) 48,500.

R. P. MARPLE, Business Manager

Sworn to and subscribed before me this 13th day of September, 1961.

JAMES P. FORD
Notary Public, State of New York
No. 30-6355500
Qualified in Nassau County
Commission Expires March 30, 1962

[SEAL]

NATIONAL ASSOCIATION OF ACCOUNTANTS
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